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The EPA has studied and evaluated the problems associated with managing hazardous wastes generated by educational institutions. The report is factual in nature. EPA was not directed by the law to develop recommendations for regulatory or statutory changes. This report identifies the statutory and regulatory requirements for educational institutions to manage hazardous waste, examines current hazardous waste management practices at such institutions, identifies the hazardous waste management problems encountered by them, and concludes by identifying possible ways for educational institutions to improve hazardous waste management. This report primarily focuses on hazardous waste generated by universities, colleges, high schools, and vocational schools. The findings of this report can also apply to waste generated at facilities providing adult education and programs of education of less than 2 years' duration, because factors affecting the management of such waste would be similar for all levels ~~of~~ and categories of educational institutions.

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REPORT TO CONGRESS: MANAGEMENT OF HAZARDOUS WASTES FROM EDUCATIONAL INSTITUTIONS

Prepared by:

U.S. Environmental Protection Agency
Office of Solid Waste

April 1989

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EXECUTIVE SUMMARY

Pursuant to Section 221(f) of the Hazardous and Solid Waste Amendments of 1984 (HSWA), the U.S. Environmental Protection Agency (EPA) is reporting to Congress the findings of its study of problems associated with managing hazardous wastes from educational institutions. EPA has prepared this report in consultation with the Secretary of Education, the States, and appropriate educational associations. The report is factual in nature. EPA was not directed to develop recommendations for regulatory or statutory changes. Therefore, this report has not recommended any regulatory or statutory changes. This report identifies the statutory and regulatory requirements for educational institutions managing hazardous waste, examines current hazardous waste management practices at such institutions, and identifies the hazardous waste management problems encountered by them. As required by the statute, it presents an analysis of the feasibility and availability of environmentally sound methods for the treatment, storage, and disposal of hazardous wastes from these institutions. The report concludes by identifying possible ways for educational institutions to improve hazardous waste management.

The 30,000 educational institutions nationwide generate about 2,000 to 4,000 metric tons of hazardous waste per year, representing much less than 1 percent of the 240,000,000 metric tons of hazardous waste generated annually in the United States. Secondary schools and small colleges and universities contribute less hazardous waste than large colleges and universities with large scientific research programs. Most schools are small quantity generators; some large universities are large quantity generators. Educational institutions have large numbers of independent hazardous waste generation points that produce variable waste streams. Generators include academic laboratories, art and vocational departments, and maintenance activities. Current waste management practices range from storage in chemical stockrooms, closets, or laboratories and disposal by the drain or dumpster to multimillion-dollar treatment, storage, and disposal facilities. Some of these practices are not allowed under current regulations. Waste management activities at educational institutions include on-site or off-site accumulation and storage; chemical and physical treatment, including recycling and recovery; incineration; and disposal. Educational institutions also transport waste to off-site treatment, storage, or disposal facilities. The types and quantities of waste generated by schools directly influence the technical and economic feasibility of using certain treatment, storage, and disposal methods. In general, secondary schools are less aware and concerned about hazardous waste management than are universities. Those colleges and universities with centralized waste management programs; more extensive research programs; and better funding, staffing, and training are better able to manage the wastes they generate. Budgetary and management constraints frequently do not allow educational institutions to develop and adequately fund waste management programs. Due to the liabilities of improper hazardous waste management, educational institutions are making greater attempts to be in compliance.

Most problems in hazardous waste management at educational institutions arise from the institutions' lack of awareness about hazardous wastes and the applicable regulations; the transient nature of student populations; the highly variable waste streams generated, which contain multiple constituents; the insufficient resources available for hazardous waste management programs; the high cost and location of off-site treatment, storage, and disposal; and the difficulties in complying with the hazardous waste regulations. Some schools are aware of appropriate hazardous waste management methods and have attempted to reduce the quantities and hazardous nature of wastes that they generate. Some schools have participated in cooperative strategies to reduce their waste disposal costs.

EPA's RECOMMENDATIONS

The following are EPA's recommendations concerning hazardous waste management at schools:

- EPA and the States can increase schools' awareness of the hazardous nature of the waste generated, the appropriate hazardous waste management techniques, and the applicable regulations by exchanging information between schools and regulators, providing guidance manuals, and holding local or regional forums to exchange ideas and to develop notification and guidance literature.

- EPA and the States can help to make schools more aware of liability costs of mismanagement and can suggest that schools use existing organizational structures to run hazardous waste management programs. This may enable schools to better use their existing funds.

- EPA, the States, and local governments can reduce schools' difficulties in complying with the hazardous waste regulations by providing Federal, State, and local guidance.

- Schools can reduce problems caused by the highly variable multicomponent waste stream by reducing the amount of waste generated, reducing the hazardous nature of the waste, and keeping better track of the waste.

- Schools can establish cooperative programs with other schools to exchange information, reduce the amount of waste generated, and reduce waste management and disposal costs.

- Schools that do not generate great quantities of waste may find mobile treatment units to be a feasible solution.

- Under certain conditions, schools can accumulate waste without a permit and then ship the waste off-site to a permitted treatment, storage, or disposal facility.

CHANGES EPA HAS MADE OR PROPOSED TO MAKE

EPA has already made or proposed to make the following regulatory changes that could alleviate problems with hazardous waste management at educational institutions:

- Issued small quantity generator requirements that are more tailored to such generators. Many schools are small quantity generators.
- Exempted from regulation small quantities of hazardous waste, when evaluated in treatability studies.
- Proposed reducing permitting requirements for small quantity burners.

COMMENTERS' SUGGESTIONS

The States, the regulated community, and other commenters have suggested the following regulatory or statutory changes, which could alleviate difficulties in complying with the hazardous waste regulations. EPA has not evaluated these suggestions, and the Agency is not recommending that these changes be made. EPA could examine these options in the future.

- EPA should clarify existing regulations as they apply to educational institutions.
- EPA should consider reducing the regulatory requirements for managing hazardous waste as they currently apply to educational institutions.
- EPA and the States should allow land disposal of all lab packs, even those containing wastes prohibited from land disposal. (This suggestion would require statutory changes.)

CHAPTER 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

Pursuant to Section 221(f) of the Hazardous and Solid Waste Amendments of 1984 (HSWA), the U.S. Environmental Protection Agency (EPA) has studied and evaluated the problems associated with managing hazardous wastes generated by educational institutions. Section 221(f) states the following:

> "(1) The Administrator of the Environmental Protection Agency shall, in consultation with the Secretary of Education, the States, and appropriate educational associations, conduct a comprehensive study of problems associated with the accumulation, storage and disposal of hazardous wastes from educational institutions. The study shall include an investigation of the feasibility and availability of environmentally sound methods for the treatment, storage or disposal of hazardous waste from such institutions, taking into account the types and quantities of such waste which are generated by these institutions, and the nonprofit nature of these institutions.
>
> "(2) The Administrator shall submit a report to the Congress containing the findings of the study carried out under paragraph (1) not later than April 1, 1987.
>
> "(3) For purposes of this subsection—
>
> "(A) the term "hazardous waste" means hazardous waste which is listed or identified under Section 3001 of the Solid Waste Disposal Act;
>
> "(B) the term "educational institution" includes, but shall not be limited to,
>
> "(i) secondary schools as defined in section 198(a)(7) of the Elementary and Secondary Education Act of 1965; and
>
> "(ii) institutions of higher education as defined in section 1201(a) of the Higher Education Act of 1965."

The report is factual in nature. EPA was not directed by the law to develop recommendations for regulatory or statutory changes. Therefore, this report has not recommended any regulatory or statutory changes. This report identifies the statutory and regulatory requirements for educational institutions to manage hazardous waste, examines current hazardous waste management practices at such institutions, identifies the hazardous waste management problems encountered by them, and concludes by identifying possible ways for educational institutions to improve hazardous waste management. EPA will make this report publicly available, to help increase the awareness of those responsible for managing hazardous waste from educational institutions. The term "hazardous waste," as used in this report, means any hazardous waste specified in 40 CFR Part 261. This report does not address the management of infectious waste from educational institutions (EPA has previously prepared a manual on infectious waste management, which can be consulted for recommendations on the management of infectious waste generated by educational institutions (see EPA 1986a)).

This report primarily focuses on hazardous waste generated by universities, colleges, high schools, and vocational schools. The findings of this report can also apply to waste generated at facilities providing adult education and programs of education of less than 2 years' duration, because factors affecting the management of such waste would be similar for all levels and categories of educational institutions. "School," as used in this report, is defined in Section 1.4.

1.2 SOURCES CONSULTED TO PREPARE THE REPORT

This report is based upon a number of sources from the published literature and is intended to identify problems shared by many educational institutions. As part of a study for EPA, Tufts University carried out a series of case studies of hazardous waste management in schools (Tufts University 1987). The researchers assumed that the management practices of schools that generate larger quantities of hazardous wastes, or schools that understand hazardous waste management, could be used as examples of environmentally sound management of hazardous waste. Thus, more colleges and universities (institutions of higher education) than high schools were included in the Tufts University case studies, even though there are about eight times as many high schools and vocational schools as colleges and universities (U.S. Department of Education 1985-86). Appendix A contains descriptions of the case study schools discussed by Tufts University in its report. The case study data presented is based on interpretations made by Tufts University researchers, as documented in their report. In addition to the case studies, Tufts University researchers contacted 47 educational institutions and State agencies in 13 States. To prepare this report, EPA consulted with the U.S. Department of Education, the States, and appropriate educational associations. Appendix E contains a list of organizations commenting on the report.

1.3 ORGANIZATION OF THE REPORT

The Resource Conservation and Recovery Act (RCRA), Subtitle C, is the major Federal statute affecting the management of hazardous waste generated by schools. Chapter 2 presents a general discussion of the background of RCRA, the hazardous waste management program, and HSWA, which expanded the scope of RCRA. Following that is a discussion of the specific RCRA regulatory requirements pertaining to schools and of the other regulatory programs that apply to hazardous waste management in schools. Chapter 3 analyzes information on the types and quantities of wastes at schools, current management practices, and the schools' awareness of the hazardous waste regulations. The schools are divided into secondary schools and higher educational institutions and, for each, the report discusses the quantity, type, and level of awareness of hazardous wastes and methods for treating, storing, or disposing of them.

Chapter 4 discusses the problems related to handling hazardous wastes at educational institutions and the feasibility and availability of environmentally sound methods for the treatment, storage, and disposal of hazardous wastes at schools. Chapter 5 identifies possibilities for improving hazardous waste management at schools. Possible solutions to these problems are divided into those to be carried out within schools, between schools, through guidance from State and Federal regulatory agencies, and by regulatory change.

This report includes six appendices. Appendix A summarizes information on the institutions interviewed in the Tufts University case studies. Appendix B includes information on RCRA requirements for treatment, storage, and disposal facilities, which may be applicable to some larger schools. Appendix C presents an example of information on how schools can identify and, in some cases, minimize the quantities of wastes they generate. Appendix D contains addresses and telephone numbers of national hotlines, and regional and State offices, as additional sources of information. Appendix E presents a list of those organizations commenting on this report. Appendix F contains reponses to questions on EPA's existing regulations.

1.4 DEFINITION OF "SCHOOL"

"School," as used in this report refers to the following categories. A "secondary school" is a day or residential school that provides secondary education, as determined by individual State laws, except that it does not include any education beyond the 12th grade. An "institution of higher education" is an educational institution in any State that meets all of the following criteria:

- It admits as regular students only individuals having certificates of graduation from high schools, or recognized equivalent of such certificates.
- It is legally authorized within the State to provide a program of education beyond high school.
- It provides one of the following: an educational program for which it awards a bachelor's degree; a 2-year program that is acceptable for full credit toward a bachelor's degree; a 2-year program that prepares the student to work as a technician at a semiprofessional level in engineering, scientific, or another technological field.
- It is a public or nonprofit institution.
- It is accredited by a nationally recognized accrediting agency or association, or, if not so accredited, is an institution whose credits are accepted, on transfer, by at least three institutions that are accredited, for credit on the same basis.

Education programs of less than 2 years' duration include those conducted by community and junior colleges and technical institutes, whether used to prepare students for vocational or avocational pursuits.

CHAPTER 2

STATUTORY AND REGULATORY OVERVIEW

Educational institutions that generate, transport, treat, store, or dispose of hazardous wastes are subject to the hazardous waste regulations issued under authority of RCRA Subtitle C. The first section of this chapter provides the history and goals of the RCRA program. The second section presents a summary of the RCRA Subtitle C program regulations that apply to all generators, transporters, treaters, storers, and disposers of hazardous wastes, including educational institutions that conduct these activities. The third section identifies other Federal regulatory programs that may affect educational institutions handling hazardous wastes.

2.1 RESOURCE CONSERVATION AND RECOVERY ACT

2.1.1 Background

Congress passed the first solid waste legislation, the Solid Waste Disposal Act of 1965, to support the development of improved waste disposal methods and of solid waste disposal plans by States and interstate agencies. This act was amended by the Resource Recovery Act of 1970 and, more significantly, by RCRA in 1976. These amendments were the first steps in requiring the development of a comprehensive program for the management of hazardous wastes. RCRA was initially amended in 1980 and extensively amended by HSWA in 1984.

RCRA requires that solid wastes be managed properly and set the following specific goals:

- Protecting human health and the environment
- Reducing waste and conserving energy and natural resources
- Reducing or eliminating the generation of hazardous wastes as expeditiously as possible

RCRA is structured into nine subtitles (A through I), six of which address general RCRA provisions. The remaining three subtitles, C, D, and I (Subtitle I was added by HSWA in 1984), address the three programs developed under RCRA: the hazardous waste management program, the solid waste management program, and the underground storage tank program, respectively. This report concerns only Subtitle C, the hazardous waste management program.

2.1.2 RCRA Subtitle C Program

RCRA Subtitle C establishes the statutory framework for a regulatory program that applies to hazardous waste from the point of generation through all treatment, storage, and disposal processes, including transportation between sites. The goal of this program is to ensure that hazardous waste is handled in a way that protects human health and the environment.

Section 3001 requires EPA to promulgate regulations identifying the characteristics of hazardous waste and listing particular hazardous wastes. Sections 3002, 3003, and 3004 require EPA to promulgate regulations establishing standards applicable to three categories of hazardous waste handlers: generators; transporters; and those who treat, store, and dispose of hazardous waste.

2.1.3 Hazardous and Solid Waste Amendments of 1984

HSWA substantially expanded the scope and requirements of RCRA. Some HSWA provisions may have significant effects on educational institutions that handle hazardous waste. For example, HSWA added Section 3001(d) of RCRA, which required EPA to promulgate standards for small quantity generators of hazardous waste (those generating more than 100 kilograms (kg) but less than 1,000 kg of hazardous waste per month). These requirements include using the Uniform Hazardous Waste Manifest form; treating, storing, or disposing of such waste at a hazardous waste facility; and tracking waste shipments. Although not all educational institutions are small quantity generators, many of them will fall into this category and are therefore now regulated.

Other major HSWA provisions may affect all or a subset of educational institutions, whether or not they are small quantity generators of hazardous waste, depending on the treatment, storage, and disposal processes used at the institutions and the types and quantities of waste handled. For example, HSWA established the land disposal restrictions program, which prohibits land disposal of specific waste streams, according to an established schedule. This provision is now part of RCRA Section 3004. The restrictions on land disposal apply to both small and large quantity generators of hazardous wastes, although not to conditionally exempt small quantity generators (see 40 Code of Federal Regulations (CFR) 268.1(c)(4)). In particular, the land disposal restrictions apply to lab packs, which are used to dispose of most hazardous wastes from academic laboratories. If a lab pack contains any restricted wastes, the entire pack may not be land disposed unless the restricted wastes are removed before land disposal, treated, or unless the waste is exempted or an extension is granted as set out in 40 CFR 268.1(c).

2.2 RCRA HAZARDOUS WASTE REGULATIONS

This section outlines the current RCRA hazardous waste regulations that apply to generators of hazardous waste, including large and small quantity generators; transporters of hazardous waste; and treaters, storers, and disposers of hazardous waste. EPA promulgated the first hazardous waste regulations on May 19, 1980. Since then, the Agency has issued additional regulations and modifications to existing regulations. The RCRA hazardous waste regulations are contained in 40 CFR Parts 260—268 and 270—272.

Part 260 presents the definitions of terms, general standards, and overview information applicable to Parts 260—266 and 268. A section in Part 260 of special concern to educational institutions is the definition of "on-site." "On-site" is defined as "the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing as opposed to going along the right-of-way . . ." (40 CFR 260.10 and 270.2). This means that a campus intersected or traversed by public roadways can be considered as one site, whereas a campus with locations at different points in a city would be considered to have several sites. The definition of "on-site" in the regulations establishes the site boundary for all generator activities (such as notification, counting of waste quantity to determine whether a generator is a small quantity generator, and determining whether manifests are required for shipments).

Part 261 identifies a waste as "hazardous" if it meets at least one of the following two criteria (and is not excluded from regulation as a hazardous waste under §261.4(b)):

- if it exhibits any of four hazardous waste characteristics—ignitability, corrosivity, reactivity, or extraction procedure (EP) toxicity—or
- if it is listed as hazardous in Subpart D of Part 261.

Specific hazardous wastes are listed in §§261.31–.33. Those likely to be generated by educational institutions are identified in Sections 3.3.2 and 3.4.2 of this report.

Parts 262–266 and 268 establish regulatory requirements for three categories of hazardous waste handlers: generators; transporters; and those who treat, store, and dispose of hazardous wastes. Educational institutions handling hazardous wastes may fall into one or more of these categories. However, educational institutions are unlikely to be "commercial" waste facilities (in the business of accepting hazardous waste from other generators for treatment, storage, or disposal) and therefore unlikely to transport, treat, store, or dispose of hazardous wastes unless they also generate the wastes. Once the hazardous wastes are generated (for example, after schools have finished using hazardous chemicals), then schools may treat, store, or dispose of the wastes on-site or ship them off-site to commercial treatment, storage, or disposal facilities. Schools that treat, store, or dispose of wastes on-site must comply with the permitting or interim status regulations.

Part 270 outlines the hazardous waste permit program. Part 271 establishes the requirements for authorization of the State hazardous waste management programs. Part 272 lists the approved State hazardous waste management programs. The hazardous waste regulations are intended to be implemented by the individual States; however, if a State does not choose to implement the hazardous waste program, EPA runs the program.

2.2.1 Generators of Hazardous Waste

Section 260.10 defines "generator" as "any person, by site, whose act or process produces hazardous waste identified or listed in Part 261 of this chapter or whose act first causes a hazardous waste to become subject to regulation."

2.2.1.1 Large Quantity Generators

As required under §262.11, all generators of solid waste must determine whether their wastes are hazardous. A "large quantity generator" is defined as (a) generating more than 1,000 kg of hazardous waste or 1 kg of acute hazardous waste per month or (b) accumulating more than 1,000 kg of hazardous waste, or 1 kg of acute hazardous waste, or 100 kg of acute hazardous spill residue. A large quantity generator may not treat, store, dispose of, or transport hazardous waste or offer it for transport without obtaining an EPA identification number. Large quantity generators who transport hazardous wastes off-site (or offer such wastes for transport) must prepare manifest forms and follow manifest procedures (§§262.20-.23); prepare Biennial Reports covering generator activities of the previous year (§262.41); and, if necessary, submit Exception Reports notifying EPA of manifest problems (§262.42). Generators must retain copies of all these reports (§262.40). Generators may store the wastes for 90 days or less before shipping, provided that they comply with §262.34. If a large quantity generator stores wastes for more than 90 days in a tank or container or disposes of waste on-site, it must have a treatment, storage, or disposal facility permit. However, under §262.34(c), a generator may accumulate up to 55 gallons of nonacute or 1 quart of acute hazardous waste in satellite accumulation areas located near the point of accumulation. The 90-day time limit begins only after the generator exceeds quantity limits at the satellite areas and brings the excess waste to the accumulation area. Generators shipping wastes off-site must also follow the pretransport requirements (§§262.30-.34), including packaging, labeling, marking, and placarding waste packages in accordance with applicable Department of Transportation (DOT) regulations.

2.2.1.2 Small Quantity Generators

Section 260.10 defines a "small quantity generator" as one generating less than 1,000 kg of hazardous waste in a month. For the purposes of this report, "small quantity generator" refers to one generating between 100 and 1,000 kg of nonacute hazardous waste per month. Small quantity generators, like large quantity generators, must make hazardous waste determinations and obtain EPA identification numbers, as specified by §§262.11 and 262.12. Similarly, small quantity generators are subject to the same requirements as large quantity generators for exports and imports of hazardous waste.

The manifest, accumulation, and recordkeeping and reporting requirements for small quantity generators, however, are less stringent than those for large quantity generators. The small quantity generator regulations in these areas are outlined below. Recognizing the small business nature of many small quantity generators, EPA has prepared a handbook explaining these requirements (EPA 1986b).

Manifest Requirements (§262.20-23): The manifest requirements for small quantity generators are the same as those for large quantity generators; however, EPA has exempted small quantity generators from manifest requirements when the hazardous waste is reclaimed under contractual arrangements that comply with §262.20(e). DOT regulations are codified in 49 CFR Subchapter C. Transporters must be in compliance with all applicable DOT requirements of 49 CFR Parts 171-179 to be considered to be in compliance with EPA's transporter regulations under 40 CFR Part 263. However, the EPA regulations generally contain the DOT requirements governing the transportation of hazardous materials (including labeling, marking, placarding, using proper containers, and reporting discharges). This ensures consistency between the EPA and DOT programs and avoids duplication or conflicting requirements. The EPA manifest satisfies DOT's shipping paper requirement, and DOT has revised its transportation regulations to cover the transportation of hazardous wastes and to include both intrastate and interstate waste transport.

Pretransport and Accumulation Requirements (§262.30-34(d), (e), (f)): Although the pretransport packaging, labeling, marking, and placarding requirements for small quantity generators are the same as those for large quantity generators, the pretransport accumulation time requirements differ. A small quantity generator may accumulate hazardous waste on-site for longer periods of time (180 days, compared with 90 days for a large quantity generator) without a permit or interim status, provided that the quantity of waste accumulated never exceeds 6,000 kg and that the generator complies with the applicable requirements of Part 265 and the safety requirements specified in §262.34(d)(5). In addition, a small quantity generator who transports his waste, or offers the waste for transport, over a distance of 200 miles or more for off-site treatment, storage, or disposal may accumulate hazardous wastes on-site for 270 days or less without a permit or interim status.

Recordkeeping and Reporting (§262.44): Small quantity generators are exempt from Biennial Reports, but they must comply with a modified form of Exception Reports. In particular, a small quantity generator has 60 days to receive its copy of the manifest before the exception reporting requirement is triggered (compared with the 45-day limit for a large quantity generator). A small quantity generator must notify the EPA Regional Administrator by mailing a copy of the unreturned manifest with a note stating that the return copy was not received from the treatment, storage, or disposal facility (40 CFR 262.42(b)). All other recordkeeping and reporting requirements remain the same as for large quantity generators.

2.2.1.3 Conditionally Exempt Small Quantity Generators

Conditionally exempt small quantity generators (those who generate less than 100 kg of nonacute hazardous waste per month) are not subject to the requirements of Parts 262–268 and 270–272, provided that they comply with the requirements specified in §261.5, as follows.

In particular, conditionally exempt small quantity generators may treat or dispose of their hazardous wastes in an on-site facility or ship those wastes to an off-site treatment, storage, or disposal facility either of which--

- Is permitted under Part 270;
- Is in interim status under Parts 270 and 265;
- Is authorized to manage wastes by a State hazardous waste management program approved under Part 271;

- Is permitted, licensed, or registered by a State to manage municipal or industrial solid waste; or
- Beneficially uses or reuses or legitimately recycles or reclaims its wastes, or treats its wastes prior to beneficial use or reuse or legitimate recycling or reclamation.

Conditionally exempt small quantity generators also may not generate more than 1 kg of acute hazardous wastes listed in §§261.31, .32, and .33(e) per month. Similarly, these generators may not generate more than 100 kg of any residue or contaminated soil, waste, or other debris resulting from the cleanup of a spill of any acute hazardous waste listed in §§261.31, .32, or .33(e) per month. If the generator accumulates more than these allowable quantities, all of the accumulated wastes become subject to the special requirements for small quantity generators in Part 262. Conditionally exempt small quantity generators also may not accumulate more than 1,000 kg of nonacute hazardous waste on-site at any time. If the generator exceeds this quantity restriction, it becomes subject to the small quantity regulations (applicable to generators of between 100 and 1,000 kg of hazardous waste per month).

2.2.2 Transporters of Hazardous Waste

An educational institution that ships its hazardous waste off-site may or may not be involved in the transportation of the waste, depending on the quantity of waste generated and the proximity of the institution to the off-site treatment, storage, and disposal facility. However, an educational institution is unlikely to be a transporter of hazardous wastes if it is not also the generator of the wastes.

Part 263 contains regulations for transporters of hazardous waste. These regulations do not apply to *on-site* transportation of hazardous waste by generators or owners or operators of hazardous waste management facilities. These regulations also do not apply to transportation of conditionally exempt small quantity generator waste (see §261.5). Generators of hazardous waste that also transport their wastes must comply with the regulations of Parts 262 and 263.

Transporters of hazardous wastes, like generators, may not operate without first obtaining an EPA identification number. Transporters storing manifested hazardous waste in containers meeting the DOT pretransport packaging requirements of §262.30 for 10 days or less are not subject to the storage regulations under Parts 264, 265, 268, and 270. In many cases, educational institutions that transport hazardous wastes may be transporting wastes for themselves, and therefore many of the transporter manifest requirements will be covered by the generator manifest regulations (§§262.20, .21). Transporters of export waste must comply with special manifest requirements; these transporters probably will not be schools. Transporters may not accept hazardous waste from a non-conditionally-exempt generator without a manifest form, and they must retain a copy of the manifest and the shipping paper (if the waste was shipped by water) for 3 years (or for such extended time as is requested by EPA). Transporters of hazardous waste who discharge waste during transportation must take appropriate immediate action to protect human health and the environment (see §§263.30 and .31).

2.2.3 Treaters, Storers, and Disposers of Hazardous Waste

Educational institutions that generate hazardous waste are subject to the treatment, storage, and disposal regulations in Parts 264 and 265 only if they treat, store beyond the accumulation time, or incinerate or dispose of their hazardous waste on-site. Generators are allowed to store their waste on-site for up to 90 days (180 to 270 days for small quantity generators) without compliance with all the requirements of Parts 264 and 265, provided that certain rules are followed (see §262.34). Although generators may treat wastes in tanks without obtaining a permit, this practice is allowed only if the tanks also do not meet the definition of a hazardous waste treatment unit that is regulated in another Subpart.

Permitted treatment, storage, or disposal facilities must comply with all the requirements of Part 264, and interim status facilities must comply with the requirements of Part 265. Appendix B outlines regulations applicable to owners and operators of treatment, storage, and disposal facilities. The regulations summarized are specific to particular waste management processes and include closure, post-closure, and financial regulations.

2.3 OTHER APPLICABLE REGULATORY PROGRAMS

Other Federal regulations may apply to educational institutions generating and handling hazardous waste. These include the Department of Transportation regulations, the Clean Water Act (CWA) regulations, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. In addition, State and local governments regulate hazardous waste.

Thus, educational institutions that have disposed of wastes that contain hazardous substances may be legally liable for cleanup if those hazardous substances are mismanaged. In fact, there are some hazardous waste sites at universities included on the National Priorities List for Superfund cleanup. For example, the University of Minnesota burned chemical laboratory wastes in an outdoor pit between 1960 and 1974, after which the pit was covered over. In 1984 the Minnesota Pollution Control Agency found that ground water as far as 2 miles to the northeast of the disposal site was contaminated with low levels of chloroform. The university has supplied families in the area with bottled water and has suggested several ways of solving the water contamination problem (Sanders 1986). In another instance, North Carolina State University buried containers of waste chemicals at an off-campus site between 1969 and 1980. Wells near the disposal site have shown relatively high concentrations of such compounds as chloroform, bromoform, 1,1,1-trichloromethane, and methylene chloride in the water. If a generator sends hazardous waste to a site that is later placed on the National Priorities List, that generator may be held liable for cleanup costs.

CHAPTER 3

CURRENT HAZARDOUS WASTE MANAGEMENT PRACTICES AT EDUCATIONAL INSTITUTIONS

3.1 INTRODUCTION

This chapter presents current hazardous waste management practices at schools and discusses school activities that generate hazardous waste. The curricula and number of students at secondary schools, colleges, and universities differ, causing differences in the types and quantities of wastes generated by these institutions. The most commonly identified wastes are those generated in laboratories. Other campus facilities however, also generate hazardous wastes, although the quantities are generally smaller.

Waste management programs at schools range from nonexistent to simple collection and disposal to extensive collection, recycling, on-site treatment, and subsequent disposal. The level of awareness at a school is reflected by the waste management program in place. Due to the liabilities of improper hazardous waste management, educational institutions are making greater attempts to be in compliance. Secondary schools are treated separately from colleges and universities in this report, both because the level of awareness is much lower in secondary schools than in colleges and universities, and because the curriculum in secondary schools tends to be consistent throughout the country, resulting in a limited number of types of hazardous waste generated. Colleges and universities, in contrast, tend to offer a variety of courses; in addition, some have extensive research programs that result in wastes with more variable characteristics.

3.2 THE NATURE OF SCHOOLS

Academic institutions are different from most other generators of hazardous waste in several respects. The mission of schools is to educate students who are generally young and developing both physically and mentally and need continual, close supervision. This is unlike industry, where, after an initial training period, workers are left on their own. In addition, industry sometimes promotes worker safety by offering bonuses to groups with consistent safety records, which tends to increase the level of worker awareness. Overall, industrial laboratories have a reputation for being more aware of safety than academic laboratories (Sanders 1986). Historically, educational institutions have not developed hazardous waste management or health and safety programs to the same extent as industry. This lack of development may stem from the large numbers of independently operating laboratories within educational institutions. Industrial research groups tend to operate under a central management, which allows relatively straightforward implementation of hazardous waste management and health and safety programs (Sanders 1986). These differences may result in a different level of commitment to safety issues and waste handling.

The funding mechanism at schools is also different from that of businesses and may influence which waste management program is adopted. Schools generally are nonprofit, with funds coming primarily from the public sector, from private donations, or through tuition. A school budget is administered by a school board, whose primary interest may be to get the most for the money available. School boards or State and municipal governments determine school budgets, and they may be compelled to consider budget-related issues not observed in industry. School boards may not have the flexibility that industry has to develop waste management programs because of budgetary restraints that can be out of their control (Tufts University 1987). In addition, waste management personnel at educational institutions do not always receive the organizational support that their industrial counterparts may enjoy. Companies may have established waste management programs to decrease their long-term liability for the waste. Academic institutions generally operate on a shorter term than industry; furthermore, the turnover in staff and students at educational institutions does not always allow for long-term considerations (Sanders 1986).

Most schools do not have complete inventories of amounts of hazardous waste generated, and some schools only dispose of hazardous wastes after large amounts have accumulated, in a waste cleanout of multiyear accumulations (Tufts University 1987). Therefore, the total quantity of hazardous waste generated by educational institutions must be estimated by piecing together data from various sources. EPA used data that it collected as part of its survey of small quantity generators (EPA 1985) to estimate the quantity of hazardous waste that schools generate. There are approximately 30,000 educational institutions acting as sources, and together they generate 2,000 metric tons of hazardous wastes. A few educational institutions can be classified as large quantity generators, and the wastes that they generate are not included in the 2,000-metric-ton estimate. Thus, the total quantity of hazardous waste generated by schools is 2,000 to 4,000 metric tons per year (Tufts University 1987), much less than 1 percent (0.0017 percent) of the 240,000,000 metric tons of total hazardous waste generated annually (EPA 1985). Some school administrators, faculty members, and maintenance workers are unaware of what constitutes a hazardous waste. Consequently, the actual quantity of hazardous waste generated may be underreported.

A typical educational institution manages hazardous wastes by first assembling wastes at one or more locations, segregating the wastes by type, and, if necessary, labeling the wastes. After the material has been stored on campus, usually for no more than 90 days, it is picked up by a waste transporting firm or waste disposal firm. The typical school generates hazardous wastes in its laboratories and relies on landfills for disposal more heavily than does the typical industrial firm. Before being transported off the campus, waste containers are usually placed in lab packs, which may be buried in landfills. (This practice is no longer allowed in many cases (see 40 CFR Part 268).) A lab pack is a 55-gallon drum capable of holding no more than 15 gallons of liquid waste in bottles or cans. The remaining content of the drum is a filler material that reduces the possibility of breakage and that can absorb any liquid that is released, in case breakage does occur. The lab packs are sometimes taken to processing facilities that combine treatment, incineration, and landfilling to dispose of the lab packs (American Chemical Society 1987.)

The following are some characteristics of educational institutions. Although most laboratories at educational institutions are small quantity generators or conditionally exempt small quantity generators, the amounts of hazardous waste generated at some universities are larger than might be imagined.

Laboratories, which can be divided into those used primarily for research and those used for teaching purposes, tend to generate most of the hazardous wastes at educational institutions. Teaching laboratories expose students to a variety of experiments to maintain student interest, and thus may generate a large volume of wastes more varied than those generated by research laboratories (Tufts University 1987). Most laboratories at educational institutions produce a relatively large variety of wastes compared with industrial plants, which may generate only a dozen or so wastes. For example, in 1984 the University of Illinois disposed of 7,300 containers holding more than 2,100 different chemicals and chemical mixtures. The University of Massachusetts, Amherst, annually disposes of about 2,000 different chemicals and chemical mixtures. These wastes will typically change in composition as new research projects start, older projects end, and the directions of research programs shift.

Arts, crafts, and vocational studies also generate hazardous wastes at educational institutions. Toxic metal compounds are used in pottery glazes and in paint pigments to provide color. Chromium, lead, and nickel are commonly used toxic metals. Building operations and maintenance activities tend to contribute the least to overall quantity (Tufts University 1987). Nonlaboratory waste includes photographic wastes, solvents used as paint thinners, and degreasing agents (McCann 1987). Chemicals used in photography tend to contain silver, to be alkaline, and to constitute a handling problem while being used (McCann 1987).

Academic waste streams are characterized by sporadic generation, a high portion of unknown and unidentified substances, and mixed hazardous waste composition (Tufts University 1987). Factors affecting waste quantities generated and changes in waste streams include the following:

- The types of activities conducted by the educational institutions
- Commencement and termination of research projects
- Ending of semesters or terms
- Acceptance of donations of types or quantities of hazardous materials not needed by a school
- Accumulation of unneeded hazardous supplies and materials because of a failure to change purchasing practices and commitments to reflect changes in curricula
- Laboratory relocation and staff changes, leading to abandonment of unidentified and hazardous materials

The organization to handle the waste stream varies among educational institutions, with the size of the laboratory program apparently the determining factor. Schools with large scientific research programs tend to be better organized to deal with hazardous waste, perhaps because of the larger quantities of wastes generated at these institutions (Tufts University

1987). The larger schools (generally, colleges and universities) have the following characteristics:

- Tend to generate 1,000 kg or more of hazardous waste per month and thus are fully subject to the RCRA Subtitle C and EPA regulatory requirements
- Have at least one EPA identification number
- Have a budget for hazardous waste packaging, transport, and disposal activities
- Have at least one full-time-equivalent person responsible for hazardous waste management, a person who is well informed and trained and who is in communication with peers at other schools
- Have recognized their responsibilities and liabilities and will have given adequate authority to responsible staff

Schools that do not have a substantial scientific research or medical program have the following characteristics (Tufts University 1987):

- Generate less than 100 kg of hazardous waste per month (conditionally exempt small quantity generator) during most months
- Probably could accumulate or store more than 1 kg of acute hazardous waste at a given time, making those wastes subject to full regulation
- Probably could accumulate or store more than 100 kg of hazardous waste at a given time, making those wastes subject to the requirements under Part 262 for generators of 100 to 1,000 kg of hazardous waste per month
- Awareness of, assignment of responsibility for, and comprehension of proper hazardous waste management will range from limited and incomplete to nonexistent
- Conformity with regulatory requirements or safe practices for handling accumulation, storage, and disposal of hazardous wastes will be the exception rather than the rule
- Proper collection, transportation, and disposal of hazardous wastes will most likely have occurred through participation in a community-organized one-time hazardous waste cleanup project, and be limited to laboratory wastes
- Expenditures for hazardous waste management will be low compared with the school's overall budget

Some schools, particularly small ones, have participated in cooperative strategies to reduce their waste disposal costs. For example, schools in a region have cooperated by using the same waste disposal company, which operates along a single designated route, and thereby have reduced their transportation costs. A cooperative project has been under way in Minnesota since 1981. The Minnesota Chemical Waste Assistance Project now serves about 160 high schools and 20 colleges throughout the State.

Nationally, 62 schools had Part B hazardous waste storage permits in 1986 (Tufts University 1987). This relatively small number is attributed to the costly and time-consuming permit application process. Some schools that do not have permits store hazardous wastes in excess of allowed limits. The stored wastes include undesignated supplies, wastes refused by transporters (including dioxin-containing materials; certain pesticides, such as ketone, sodium peroxide, and red phosphate; and reactives, such as ethers and picric acid), and unidentified past accumulations (Tufts University 1987).

From the Tufts University case studies, it appears that the principles and specific requirements applicable to accumulation of hazardous wastes at or near the point of generation ("satellite accumulation," 40 CFR 262.34(c)) are neither well nor widely understood. The practice of satellite accumulation is widespread; examples include accumulation in storage cabinets, other sites in or near laboratories, art studios, and maintenance shops. Generally, neither accumulation nor storage facilities at high schools and small colleges were adequate or in compliance with the regulations; furthermore, they frequently overlooked the more stringent requirements applicable to acute hazardous wastes. Conversely, larger universities managed storage and accumulation well (Tufts University 1987).

Information on the types and quantities of wastes generated by educational institutions can be further broken down to differentiate between secondary schools and colleges and universities.

3.3 SECONDARY SCHOOLS

3.3.1 Introduction

Very little information is available on the quantities and types of wastes generated by secondary schools in the United States. There are approximately 16,000 secondary schools in this country, of various sizes, as seen in Table 3-1. These schools are traditional high schools, vocational schools, and schools that combine both types of curricula. The types of wastes generated by secondary schools can be inferred from their curricula and the types of materials likely to be used. In secondary schools, hazardous waste management is viewed as an element of school safety, rather than as a materials handling and disposal issue.

High school personnel generally have a lower level of awareness and concern and a more limited knowledge of regulations and proper procedures than do university personnel. Tufts University (1987) researchers found that several of the high schools that they studied had no budget for dealing with hazardous materials. In fact, they encountered some administrators and science teachers who had no interest in developing waste management programs.

Table 3-1

Number and Enrollment of U.S. High Schools (Including Vocational High Schools) (1982-83)

	Schools		Students Enrolled	
Enrollment	No.	Percent	No.	Percent
≥9,999	1,632	10	24,236,000	61
1,000–9,999	5,501	35	12,626,000	32
<1,000	8,725	55	2,985,000	7
TOTAL	15,858	100	39,847,000	100

Source: U.S. Department of Education, National Center of Educational Statistics, *Digest of Educational Statistics*, Washington, D.C., 1985-86, table 58.

Seconday schools' current waste disposal practice is to use the drain or the dumpster, or to follow other practices not authorized by the RCRA regulations. However, the level of awareness on the part of school administrators and faculty members is increasing, which is likely to change current practices. Faculties and administrators accept the substitution of less hazardous materials into school curricula on the basis of student safety, but they are less ready to accept substitution on the basis of waste management.

3.3.2 Sources and Characteristics of Wastes

Specific types of high school courses associated with hazardous waste generation are listed in Table 3-2. Included in the table are the differences in the percentages of schools offering these courses from 1973 to 1982. Science curricula in secondary schools include courses in chemistry, biology, earth sciences, and physical sciences. The National Institute of Occupational Safety and Health has evaluated experiments performed in secondary schools and the hazards associated with them (National Institute of Occupational Safety and Health 1980). The data reveal that both toxic and nontoxic materials are used, including some that are hazardous because of flammability or reactivity.

Nonacademic activities at secondary schools also generate hazardous wastes. For example, boilers generate waste as part of their water treatment procedure and need to be cleaned to blow out any materials (for example, rust) that accumulate in the pipes (Tufts University 1987).

3.3.3 Quantity of Waste Generated

Some studies are under way to determine the volumes of hazardous waste generated by secondary schools, since there are few data available on such volumes. In Minnesota in 1983, 78 high schools generated a yearly average of 40 kg each of hazardous waste (Ashbrook and Reinhardt 1985). Part of the difficulty in determining these quantities is that some school personnel do not know what constitutes a hazardous waste.

Many common practices at schools make it difficult or impossible to determine how much hazardous waste is actually generated. For example, a school may conduct a one-time cleanout of stockpiles of unused materials, perhaps once every 10 years. (When the chemicals are discarded or intended for discard, they become waste and subject to these regulations. There has been no systematic study of how much waste is generated in this process. Another practice that makes it difficult to specify how much waste schools generate is that hazardous waste is disposed of routinely by using the sewer system as the dumpster (Tufts University 1987, Sanders 1986). Volatile compounds maybe stored under fume hoods while they vaporize and are disposed (Stanley 1987, Kizer 1987). Many of these practices are not considered to be safe laboratory practices, and in some cases they are not allowed under current regulations.

Table 3-2

High School Course Offerings Likely To Produce Hazardous Waste

Course	Percentage of Schools Offering Course		Potentially Hazardous Wastes
	1973[a]	1982[b]	
Agricultural Arts:			
Agriculture	29.7	48.4	Pesticides, fertilizers
Horticulture/Landscaping	1.6	23.4	
Graphic Arts:			
Art	74.0	89.6	Oil-based paints, solvents
Graphics	6.0	33.3	Inks, solvents, acids
Jewelry/Metalwork	6.9	9.8	Acids
Pottery/Ceramics	16.2	28.8	Metals in glazes, silica in clays
Painting/Drawing/Design	19.6	36.0	Oil-based paints, inks, solvents
Photo/Filmmaking	6.4	14.1	Silver, developing and fixing chemicals
Industrial Arts:	75.5	90.6	
Carpentry/Woodworking	46.1	70.3	Stains, solvents, wood preservatives
Leather/Textiles/Upholstery	2.1	6.9	Dyes
Plastics	4.1	4.8	Ketones
Photography	5.5		Silver, photochemicals, inks, solvents
Printing/Photo/Graphics	3.3		
Metalworking/Foundry	33.8	41.7	Metal dust
Welding	9.0	31.7	Lead solder
Auto Mechanics	18.3	47.5	Degreasing solvents, oil, grease

Table 3-2 (Continued)

Course	Percentage of Schools Offering Course		Potentially Hazardous Wastes
	1973[a]	1982[b]	
Power/Auto Mechanics	17.6	33.1	
Science Courses:			
Natural Science	89.3	99.7	Various chemicals, acids, bases
Biology	79.9	97.8	
Chemistry	88.1	89.4	
Avocational Courses:			
Trades and Industry	24.0	94.0	
Graphic Arts	3.1	3.2	Inks, solvents
Printing/Lithography	1.9	10.3	
Textile/Leather Products	1.3	10.3	Dyes
Body and Fender Mechanics	4.4	17.9	Batteries, paints, degreasing solvents, oil, grease, acids, alkaline waste
Automobile Mechanics	12.5	11.7	
Masonry	2.5	9.5	Paint, solvents, muriatic acid
Carpentry	6.4		Stains, solvents, paints, wood preservatives
Woodworking, 1st Year	4.0		
Woodworking, Advanced	3.9	4.3	
Machine Shop	7.0	17.7	
Sheet Metal	1.8	0.1	Stripping and cleaning solutions, plating bath residues, acids, bases, metal dust
Metalworking	1.2	0.7	
Welding and Cutting	5.7		
Cosmetology	5.1	18.5	Various chemicals

Table 3-2 (Continued)

Course	Percentage of Schools Offering Course 1973[a]	Percentage of Schools Offering Course 1982[b]	Potentially Hazardous Wastes
Health Courses:			
Allied Health		20.6	Various chemicals and pharmaceuticals
Laboratory/Chemical Technology		4.5	
Nursing		11.7	

[a] Based on survey of 7,850 (out of 15,306) schools.

[b] Based on survey of 941 (out of 15,667) schools.

Source: A Trend of High School Offerings and Enrollment: 1972-1973 and 1981-1982, Evaluation Tech., Inc., under contract 300-83-0114 with the Department of Education.

3.3.4 Storage and Disposal of Wastes

At secondary schools, chemicals are stored either in chemistry stockrooms or in closets. In a number of schools, there is a disregard for the appropriate ways to store chemicals. Teachers frequently shelve materials alphabetically, which may result in incompatible chemicals being stored near one another, so a potentially reactive situation could exist (New York State Environmental Facilities Corporation 1985). This is not considered safe laboratory practice and, in some cases, may not be allowed under current regulations.

Wastes generated by schools can be placed in three disposal categories:

- Wastes that are nonhazardous and disposable at the school
- Wastes that are hazardous but treatable at the school, using such methods as detoxification
- Wastes that are hazardous and treatable only at a commercial treatment, storage, or disposal facility (New York State Environmental Facilities Corporation 1985)

One of the difficulties that secondary schools have in disposing of wastes at an approved treatment, storage, or disposal facility is the cost. Secondary schools' wastes tend to be in small volumes of variable compositions, which can drive up disposal costs on a per gallon basis. Waste transporters can only operate cost-effectively if they have full loads.

3.4 COLLEGES AND UNIVERSITIES

3.4.1 Introduction

There are approximately 3,300 colleges and universities in the United States (Table 3-3). The variation in size and length of program tends to influence the level of awareness of the issue of hazardous waste management. In general, larger schools with extensive research programs have the most comprehensive waste management programs. Smaller schools may lack the funds or the staff to deal with hazardous waste management, although Howard H. Fawcett (as referenced by Sanders (1986)) has stated: "If the smaller schools had a real desire to do a good job, they could find the money somewhere. Often the amount of money needed is not all that great, perhaps a few thousand dollars a year."

3.4.2 Sources and Characteristics of Wastes

There are a number of courses that can be expected to generate hazardous wastes at colleges and universities, as seen in Table 3-4. Most of the hazardous waste is generated by laboratories. Tufts University researchers found that, in one case study university, 75 percent of the hazardous waste was generated in research laboratories, 20 percent was generated in teaching laboratories, and 5 percent was generated in machine shops. Another

Table 3-3

U.S. Institutions of Higher Education by Type and Control, Fall 1983

Category	Type of Institution			
	Private		Public	
	No.	Percent	No.	Percent
2-Year Institutions	355	28	915	72
Universities and Other 4-year Institutions	1,447	72	565	28
TOTAL	1,802	55	1,480	45

Source: Department of Education, National Center for Educational Statistics, *Digest of Educational Statistics,* Washington, D.C., 1985-1986 (after table 104).

Table 3-4

College-Level Courses Likely To Result in Hazardous Waste Generation

Course Category	Types of Potentially Hazardous Wastes
Agribusiness and Agricultural Production	Pesticides, fertilizers, animal pharmaceuticals
Agricultural Sciences	
Allied Health Services	Chemicals, pharmaceuticals
Biology	Various chemicals
Chemistry	
Communication Technologies	Photochemicals, lubricants
Computer and Information Sciences	Lubricants, oil
Construction Trades	Paints, solvents, inks
Crafts and Designs	
Diagnostic and Treatment Services	Various chemicals
Engineering	Waste oils, solvents, degreasers
Environmental Control Technologies	Spent charcoal filters
Fine Arts	Paints, solvents, metals, inks
Health Sciences	Various chemicals
Industrial Production	Degreasing solvents, oil, grease, acids, alkaline bases
Life Sciences	Various chemicals
Mechanical and Electromechanical Technologies	Solvents
Mechanics and Repairers	Degreasing solvents, paints, oils
Medical Laboratory Technologies	Various chemicals and pharmaceuticals
Multi/Interdisciplinary Studies	Various wastes
Physical Sciences	Various chemicals
Physics	
Precision Production	Degreasing solvents
Science Technologies	Various chemicals
Visual and Performing Arts	Developing and fixing chemicals

Source: Index of Majors 1985-1986, College Entrance Examination Board, New York, 1985.

university reported that 75 percent of its waste came from chemistry research laboratories, chemistry classrooms, the college of pharmacy, engineering and physics, and vehicle maintenance and arts. At universities where medical research is conducted, wastes from research and chemical laboratories in the biomedical area may dominate the waste stream. These laboratories accounted for 55 percent of the hazardous waste generated at the University of Washington and its related facilities (Ellefson 1986).

The types of laboratory wastes vary, depending on the research projects being conducted as well as the course offerings in a given academic year. Ashbrook and Reinhardt (1985) reported that the major laboratory wastes are spent solvents, spent acids and bases, and unwanted stock chemicals. Minor laboratory wastes include spent toxic metals, degraded stock chemicals, contaminated laboratory apparatus, chemicals that react with air and water, potentially explosive chemicals, cyanides and sulfides, pesticides, polychlorinated biphenyls, and small gas cylinders. The University of Illinois disposed of 7,300 containers holding more than 2,100 different chemicals and chemical mixtures in 1984. The University of Massachusetts, Amherst, disposed of approximately 2,000 different chemicals and chemical mixtures each year. The quantity of an individual waste ranges from a 55-gallon drum down to an ampoule (Sanders 1986). The University of Minnesota determined that in 1981, 1,350 of the most frequently used chemicals could be designated as hazardous (Ashbrook and Reinhardt 1985).

Maintenance activities generate certain types of hazardous wastes, such as spent solvents. Solvents are used as degreasing agents or paint thinners, and the solvents used by art departments and maintenance operations have been pooled before disposal. Additional maintenance materials that could be hazardous are bleaches; pesticides; fertilizers; water treatment chemicals, such as chlorine; and polychlorinated biphenyls from transformers (Koertge 1981).

3.4.3 Quantity of Waste Generated

Some universities and colleges know in great detail the quantities of hazardous waste that they generate, whereas others have no knowledge of the quantities generated. This is a reflection of the various levels of effort that schools have put into waste management programs. The quantity of waste generated is increasing. At the University of Wisconsin, 36,000 kg of hazardous wastes were generated in 1984; 50,000 kg, in 1985; and 105,000 kg, in 1986. The quantity of hazardous waste generated by the University of Illinois at Urbana-Champaign grew from 27,500 kg in 1984 to 37,000 kg in 1985. The University of Maryland, College Park, increased its hazardous waste shipments to an outside disposal firm from 150 55-gallon drums in 1980 to 320 drums in 1985 (Sanders 1986). The increase in quantity of hazardous waste generated resulted in a 113-percent increase in cost of handling and disposing of wastes at the University of California, Davis (Ashbrook and Reinhardt 1985, Sanders 1986).

In an effort to minimize the quantity of hazardous waste generated, colleges and universities are beginning to develop various programs, ranging from scaling down experiments conducted in teaching laboratories to operating chemical exchange services between departments (Sanders 1986). Implementation of these programs is expected to decrease the quantity of hazardous waste for disposal from colleges and universities. For example, Professor Dana Mayo of Bowdoin College has developed a microscale organic chemistry curriculum, using 1 to 10 milligrams of material, whereas miniscale experiments use 15 to 30 milligrams of material and traditional experiments use 50 to 100 milligrams (Sanders 1986). There are a number of advantages to scaling down experiments. Clearly, the quantity of material that a student is exposed to decreases, as does the quantity of waste generated. One of the disadvantages is that, because of the smaller quantities of material generated, more sensitive analytical equipment may be required, and this could be a substantial expense. Steve Larson (1986), director of the Office of Environmental Health and Safety at Northeastern University, states that the full transition to microscale experiments probably will not occur, because the transition to miniscale experiments is already very costly and has not been determined to be cost-effective for Northeastern University, given the costs of disposing of the larger waste quantities currently generated. Mr. Larson states further that disposal costs would determine the agenda for the transition to microscale experiments, despite the advantages of microscale laboratory practices.

Another example of a way schools have minimized the amount of waste that needs disposal is the use of small-scale silver recovery devices in photographic laboratories. These devices remove silver salts from a filter system or a tank containing a sodium thiosulfate solution by an electrolytic process. Cartridges are used to collect the silver and then are returned to the manufacturer, which supplies new cartridges and pays for the silver. Other options for silver recovery include pickup of exhausted sodium thiosulfate solution by a silver reclamation company, use of chemical recovery methods, and metal displacement precipitation (Tufts University 1987).

At some schools, there are transfer services that take unwanted chemicals from one department and make them available to another department that needs them. This type of exchange decreases the stockpiling of chemicals in storerooms, and reduces the operating cost of some laboratories, because purchasing requirements are diminished. For example, Southern Illinois University at Carbondale operates a comprehensive waste exchange through its Pollution Control Department. In 1978, more than 3,000 different chemicals and 300 gallons of solvents were exchanged in this program, at a savings of more than $20,000 in purchasing costs (Meister 1981). The University of Massachusetts, Amherst; the University of Wisconsin, Madison; and other schools also operate similar formal and informal exchanges. The University of Wisconsin recycles many unwanted but reusable chemicals that are typically disposed of, and it publishes a newsletter five times a year that contains a list of reusable chemicals. This type of program has saved more than $20,000 annually at the University of Wisconsin (Ashbrook and Reinhardt 1985). By emphasizing segregation of nonhazardous from hazardous wastes, recycling, incineration, and chemical treatment, the University of Wisconsin, Madison, substantially reduces off-site disposal. Each year this university generates about 25,000 gallons of hazardous waste, but only 550 gallons, or approximately 3.5 percent, of waste is shipped off-site (Reinhardt 1987). There are many more waste exchanges, such as the Northeast Waste Exchange in

Syracuse, New York, and the Michigan Products Information Exchange in Menominee, Michigan, that are not specific to only a few schools, but that allow many schools to participate (Tufts University 1987).

The use of less hazardous materials also is being adopted. At the University of Wisconsin, Madison, for example, chromic acid cleaning solutions are no longer available from the chemical stockroom, and a less hazardous cleaning solution is available. This type of substitution does not necessarily reduce the quantity of waste generated, but it may reduce the potential hazard of the waste (Ashbrook and Reinhardt 1985).

3.4.4 Storage and Disposal of Wastes

The discussion of chemical storage can be divided into two areas: stockpiled or new chemicals or supplies and wastes that have been removed from the source (for example, a science laboratory or an art studio). If these hazardous wastes are not stored properly, they can pose a threat to school safety and, in some cases, may not be allowed under current regulations.

Schools have a large number of potential uses for chemicals. Typically, chemistry and science departments store hundreds and sometimes thousands of chemicals, and art studios and maintenance facilities store smaller numbers of less diverse supplies. In addition to newly purchased chemicals, schools also must store chemicals whose shelf lives have expired and chemicals that are no longer needed; if these materials are intended for discard, they become wastes and are subject to the hazardous waste regulations. This type of stockpiling can cause a buildup of hazardous wastes. If all the chemicals are stored in or tracked by a central agency within the school, the possibility exists for the implementation of recycling programs, as discussed above. Centralization can also help to minimize excessive purchasing of widely used chemicals (Ashbrook and Reinhardt 1985, Sanders 1986). Once materials have been determined to be wastes, they generally are taken by health and safety personnel to a central location, where they are stored and prepared for disposal.

The levels of effort at colleges and universities for the storage and disposal of wastes vary. A large number of schools continue to dispose of chemical wastes via sewers and dumpsters. At Northeastern University, very small rooms (12 by 18 feet) are used for storage, because there is a high turnover of wastes from storage to disposal (Larson 1986). Southern Illinois University at Carbondale uses a converted mobile home, as well as the Pollution Control Laboratory, to store wastes. Volatile organics are stored in the Pollution Control Laboratory, because the university either treats these wastes or stores them under fume hoods. In the trailer, potentially reactive wastes are stored in separate rooms to minimize potential hazards (Meister 1981). The level of awareness is increasing, and cooperative programs are being instituted to handle the small quantities of materials generated by small colleges and universities. The Commonwealth of Massachusetts, for example, has organized a "milk run" to consolidate wastes from colleges and universities. Minnesota operates a similar program through the University of Minnesota (Sanders 1986). Stanford University has built a

$7 million installation for the storage, treatment, and disposal of wastes. The facility has separate areas for handling infectious biological wastes, chemical wastes, and low-level radioactive wastes. A high temperature incinerator is operated at the facility. The University of Wisconsin and the University of Arizona also have installed incinerators (Sanders 1986).

Some disposal options are conducted in the laboratory. One option is the neutralization of acids and bases, followed by disposal through the sewer. Other destruction techniques are available if the researcher is willing to investigate the possibilities. The advantage of in-house treatment and disposal is that it reduces the space needed for storage and decreases disposal costs (Ashbrook and Reinhardt 1985, Sanders 1986). Federal rules allow generators to conduct treatment in tanks or closed containers without a permit, under 40 CFR 262.34, but only if the tanks do not also meet the definition of a hazardous waste treatment unit that is regulated in another Subpart. States may have more stringent requirements. Discharges to sewers are generally regulated at the local level by restrictions on publicly owned treatment works.

CHAPTER 4

PROBLEMS ASSOCIATED WITH MANAGEMENT OF HAZARDOUS WASTES FROM EDUCATIONAL INSTITUTIONS

This chapter identifies the problems encountered in managing hazardous waste from educational institutions (Section 4.1) and discusses the feasibility and availability of methods to manage such waste (Section 4.2).

4.1 PROBLEMS RELATED TO HAZARDOUS WASTE HANDLING

Educational institutions, like other entities that generate and manage hazardous wastes, are faced with a range of problems. The following features create hazardous waste management problems unique to schools:

- Most schools do not generate large quantities of hazardous waste, and can be classified as conditionally exempt small quantity generators (generators of less than 100 kilograms (kg) of hazardous waste per month).
- Educational institutions have large numbers of independent hazardous waste generation points that produce variable waste streams.
- Educational institutions are subject to budgetary and management constraints that can limit the effectiveness of a waste handling system, which may be reflected in inadequate funds for waste management programs and staff.
- Although schools may use existing health and safety programs to disseminate information on proper hazardous waste handling, many schools do not have such programs.
- Faculty and staff at educational institutions have not been aware of the regulations that may apply to them, or they may have chosen to ignore the regulations, believing they do not have to comply.
- The transient nature of student populations makes it difficult to educate students and to identify waste streams.
- Educational institutions have had difficulties in obtaining a RCRA Part B permit.

Despite the higher level of awareness at the larger schools, the possibility exists that schools will not properly classify, inventory, and manage all waste streams, most often in one of the following ways (Tufts University 1987):

- Failure to identify minor waste streams (for example, from maintenance programs or shops)
- Noncompliance with regulations concerning transportation and the need for multiple identification numbers where public highways separate campuses or laboratories on a campus
- Storage of wastes that transporters will not accept

The identification of wastes may require chemical analysis of some very small quantities of waste if labels are missing. The variety of wastes requires laboratories at schools to do an exceptional amount of paperwork to keep track of wastes they ship to off-site disposal facilities (Sanders 1986). The wide variety of wastes may make regulatory compliance difficult, because EPA requires that all wastes buried in landfills be identified by chemical name. Educational institutions have encountered some difficulties in complying with hazardous waste regulations, because of the complexity of the rules. Some of these difficulties are alleviated by the small quantity generator regulations 40 CFR 261.5.

The waste problem from the arts at colleges and universities varies from that at secondary schools because of department sizes and operating budgets (McCann 1987). For example, in secondary schools, ceramic glazes are purchased premixed, whereas at larger schools they may be purchased as powders and mixed when needed. These powders are likely to introduce a short-term inhalation hazard during mixing and a long-term storage problem. Silver is a component of photographic fixer and is the principal waste generated by black-and-white photography. Color processing is more complex and involves the use of a variety of chemicals, some of which are potentially hazardous. There is a lack of knowledge, particularly on the part of nonscience faculty, of what constitutes hazardous waste and which activities generate hazardous waste. Nonscience departments are beginning to recognize safety and health as issues. In the arts, however, there is a reluctance to substitute a nonhazardous material unless it can be demonstrated that it will produce the desired aesthetic effect (McCann 1979).

4.1.1 Waste Identification

Under the Resource Conservation and Recovery Act (RCRA), EPA regulations sometimes require detailed knowledge of constituents and properties of waste streams so they can be managed properly. This can be difficult because the large number of sources of waste generation results in a variable multicomponent waste stream. A detailed analysis of each waste container can become very costly, with analysis costs sometimes exceeding disposal costs (Ashbrook and Reinhardt 1985). Also, such recordkeeping requires a great deal of time and paperwork for both the school and the waste handler, due to the highly variable waste stream. This can make waste handling companies reluctant to handle wastes generated by educational institutions.

The above discussion assumes that the laboratory worker or other responsible staff member knows that the material generated is a hazardous waste. In the absence of this knowledge, it is imperative that all materials be labeled whether or not they are hazardous. As a result of the high turnover rate in the student population, students may leave without properly disposing of or labeling their unused or synthesized materials. If staff and students are not diligent about maintaining records on which chemicals are placed in waste containers, the hazardous waste manager becomes responsible for conducting analysis as necessary and labeling the waste containers properly.

4.1.2 Handling and Collection

Ideally, proper handling of chemicals begins with understanding the potential hazards related to their use. Each laboratory coordinator or the health and safety officer should be responsible for disseminating information on chemicals being used in the laboratory. The dissemination of information can involve discussions on reactivity and possible health effects. In theory, this type of activity appears to be relatively straightforward; in practice, this may not be the case. Smaller schools (high schools and small colleges and universities) generally do not have the staff to handle hazardous waste management and to communicate chemical hazard information. Apparently, these schools give waste handling a low priority. At some schools, the health and safety officer is a member of the campus security force and may have little training in waste management (Sanders 1986). Another problem related to waste handling is the attitude of professors and research groups towards waste handling. Some research groups consider themselves autonomous and operate with little outside supervision; they may not adhere to instructions from the health and safety officer because the group members believe either that it is not their responsibility to deal with the waste or that they know more about safety issues than the safety officer. Other researchers believe health and safety procedures interfere with their academic freedom (Sanders 1986).

If schools do not have active hazardous waste programs, wastes may accumulate in laboratories, creating potential hazards and increasing the likelihood that schools will have to dispose of large quantities of materials. Wastes may not be packaged properly when they are transported for disposal. These problems may arise from insufficient resources available for hazardous waste management programs. School administrators and others who may deal with waste management are not always aware of the regulations and hazards. The basic problem of waste handling and collection is one of information dissemination (Tufts University 1987, Sanders 1986). If school officials are not aware of regulations to which their institutions are subject, they cannot respond adequately to waste management issues. However, this does not relieve them of the obligation to comply with the hazardous waste management regulations.

4.1.3 Storage and Packaging

The issue of storage of hazardous materials at educational institutions can be divided into two categories: storage of chemicals for use in laboratories or classrooms and storage of materials that are considered wastes. Generally, chemicals are stored on shelves in laboratories and classrooms and in closets and stockrooms. In some secondary schools and in some colleges and universities, materials are shelved alphabetically, possibly placing incompatible materials close together and creating a potentially reactive situation (New York State Environmental Facilities Corporation 1985). Schools have also accumulated wastes in fume hoods, storage cabinets, and other places in or near laboratories, art studios, and maintenance shops, subjecting laboratory workers to accidental exposure to hazardous wastes. Some professors and teachers may store sizable amounts of chemicals on laboratory shelves for 10 to 20 years, sometimes long after they have ceased to be of use; some of these chemicals may have dangerously deteriorated (Sanders 1986).

Once materials are determined to be of no use to a particular laboratory, they can be either stored before disposal or recycled and used by other laboratories or departments, if they are still usable. If the materials are to be discarded, then they are considered RCRA wastes and are subject to the hazardous waste regulations. Thus, they need to be packaged for disposal, accumulated, and stored according to these regulations. If the school has developed a recycling program, then the materials must be stored in such a way that they can be retrieved as needed. This approach requires the commitment of space to the waste management program and to safely store materials, to minimize reactions between chemicals stored on the shelves. Additionally, this may require an initial investment to modify existing space so that the area is well ventilated and well suited for segregating wastes.

Wastes should be stored in 55-gallon drums, tanks, or other suitable containers (1-quart maximums are allowed for acute hazardous wastes) (see 40 CFR 262.34). Small containers of laboratory waste often are placed for transport in a lab pack. A similar pack with a fiber drum has been used when the material is intended for incineration. Once wastes are packed, if they are not immediately transported off-site, they must be stored in an area where they will be secure until off-site disposal. The size and sophistication necessary for a storage area depend on the length of time the materials are stored before disposal and on the quantities stored by the school (Sanders 1986).

4.1.4 Transportation

The transportation of hazardous wastes occurs within the educational institution or off the school property, to an approved treatment, storage, or disposal facility. The Tufts University researchers (1987) found that in a number of schools, untrained individuals transport wastes from the points of generation to the storage locations. The person in charge of waste management activities needs to be aware of the potential hazards of both on- and off-site transport. If the wastes are moved from a laboratory to a storage facility along a street to which the public has free access, the waste is subject to the EPA manifest requirements and the DOT regulations, which require that the generator and the transporter have the appropriate approvals and that the materials be properly packaged and manifested (National Research Council 1983). It is not known whether schools follow the necessary procedures when moving materials through campuses along public streets (Tufts University 1987).

4.1.5 Treatment

Treatment can render a hazardous material less hazardous. A number of laboratory methods have been used, including neutralization and distillation. Normally, treatment devices are subject to hazardous waste tank rules. However, elementary neutralization and recycling activities (for example, recovery of solvents) are exempt from regulation (see 40 CFR 261.6). In addition, on-site treatment of hazardous wastes in accumulation tanks is exempt from the permitting requirements, although it must be in accordance with other requirements. The treatment of waste can still result in some residual waste requiring disposal or additional treatment off-site. This residual waste may, in fact, still be considered hazardous and be subject to the hazardous waste regulations. If the school does not use exempt treatment methods, then it may find that the procedure to obtain the permit is costly, and the school may decide to manage wastes in a different manner (Sanders 1986).

Two treatment methods not fully in compliance with RCRA regulations were used in the case study schools, described by the Tufts University (1987) researchers: evaporation and neutralization. They observed limited treatment during and after laboratory experiments or after accumulation. Evaporation was commonly used in instructional laboratories to remove water or solvents from chemical samples. The chemicals were generally exposed to air under fume hoods or in large open-air drying pans or evaporated in a drying oven. Records were not available to document the quantities or types of chemicals treated in this manner. Unlabeled samples in fume hoods were observed during site visits, suggesting that compatibility of stored chemicals may not have been assured. The case study schools also neutralized wastes by using on-site laboratory procedures, either incorporated into the experiments themselves or performed by a laboratory assistant or instructor after the hazardous wastes had been collected from individual students. None of the schools that were small quantity generators operated "elementary neutralization units" as defined in 40 CFR 270.2. The extent to which these techniques were used and the resulting reductions in waste quantities were not documented in the Tufts University report (1987).

4.1.6 Incineration

Incineration is an effective method for the destruction of organic compounds and biological materials. The major disadvantage of incineration is that, at least for hazardous waste, it is a relatively expensive, complex technology that has a high energy requirement. Incineration produces an ash that may be a hazardous waste, and the method has potential for air pollution. The operation of an incinerator at an educational institution requires a large commitment of funds for construction and for safe and efficient operation, which includes ensuring the availability of trained personnel. The major problem associated with incineration is that most schools, especially the smaller ones, cannot afford to employ it. The technology is potentially viable only for the large institutions because of the high costs involved in construction and maintenance, the complex and expensive permitting, and the need for a highly skilled staff to operate the units (Tufts University 1987).

Since the chemical composition of the waste stream constantly changes, it is difficult for schools to characterize the nature of the incinerator emissions. This situation requires complex permitting and operating procedures. A benefit of incineration, however, is to reduce the risk and liability associated with hazardous waste management, because incineration reduces the volume and degree of hazard of the waste.

4.1.7 Disposal

Schools face several obstacles to ensuring disposal of hazardous wastes in an appropriate manner:

- The need for funds to pay for an outside handler
- The need for funds for an on-site coordinator to manage the waste management program
- A lack of clear understanding of the regulations and legal requirements
- A lack of motivation to adhere to the law because of the perception in the regulated community that regulatory enforcement agencies generally do not place a high priority on compliance by schools (Sanders 1986)
- The frequent complaint by school environmental safety officers that many academic research groups consider themselves to be autonomous and do not follow officers' instructions
- The large variety and small quantities of wastes produced by schools
- The continually changing nature of the waste stream, meaning that its composition is not always known
- The prohibition from landfills of wastes containing explosive chemicals and liquid wastes that may be generated in school laboratories and the refusal of some waste handling firms to handle them

A major problem that schools face is the high cost charged by some waste handlers for small amounts of wastes. The variable waste stream and small quantities can make reporting requirements extremely cumbersome. Washington State University was informed by its waste handler that it would no longer accept the university's wastes because they represented only 1 percent of the handler's total waste, but accounted for 99 percent of the handler's problems (Sanders 1986). A number of universities have reported that their costs have risen by as much as 118 percent in the past 5 years (Sanders 1986, Ashbrook and Reinhardt 1985). The cost issue is significant for all schools, but it is especially acute for secondary schools and small colleges.

Disposal methods include discharge to a sanitary sewer, dumping in a dumpster, or burial in a landfill. All of these methods are used to some extent by educational institutions (Sanders 1986). Depending on the generator's category (for example, less than 100 kg per month), these activities may violate Federal or State rules. The effectiveness of a waste management program in monitoring disposal safety varies from school to school, and sometimes within departments. Schools that place a low priority on waste disposal tend to restrict funding for such programs. Awareness of the regulations and of safe disposal practices is increasing, however. With the exception of using drains, most educational institutions do not actually perform the disposal task themselves. Most schools depend on off-site landfills or discharge to the drain and ultimately to the water treatment plant as their primary disposal method. As disposal costs increase and regulations limit the use of landfills, educational institutions must search out alternative solutions to their waste management problems.

Thus, educational institutions that have disposed of wastes that contain hazardous substances may be legally liable for cleanup if those hazardous substances are mismanaged. In fact, there are some hazardous waste sites at universities included on the National Priorities List for Superfund cleanup. For example, the University of Minnesota burned chemical laboratory wastes in an outdoor pit between 1960 and 1974, after which the pit was covered over. In 1984 the Minnesota Pollution Control Agency found that ground water as far as 2 miles to the northeast of the disposal site was contaminated with low levels of chloroform. The university has supplied families in the area with bottled water and has suggested several ways of solving the water contamination problem (Sanders 1986). In another instance, North Carolina State University buried containers of waste chemicals at an off-campus site between 1969 and 1980. Wells near the disposal site have shown relatively high concentrations of such compounds as chloroform, bromoform, 1,1,1-trichloromethane, and methylene chloride in the water. If a generator sends hazardous waste to a site that is later placed on the National Priorities List, that generator may be held liable for cleanup costs.

4.1.8 Recordkeeping

EPA's hazardous waste regulations require that all wastes buried in landfills be identified by waste code. Wastes of unknown composition may need chemical analyses (which can be expensive and time-consuming). If a university generates over 10,000 containers of waste in a year and if each container holds a different mixture of chemicals, the university may have to make over 10,000 entries on the waste record list.

4.2 FEASIBILITY AND AVAILABILITY OF HAZARDOUS WASTE MANAGEMENT METHODS

This section focuses on waste management methods that schools may use to treat, store, or dispose of their hazardous wastes, especially "the feasibility and availability of environmentally sound methods for the treatment, storage or disposal of hazardous wastes from educational institutions, taking into account the types and quantities of such wastes which are generated by these institutions, and the nonprofit nature of these institutions" (HSWA, Section 221(f)(1)). This section discusses the feasibility and availability of the following on-site and off-site hazardous waste management methods: accumulation and storage; transportation; chemical and physical treatment, including recycling and recovery; incineration; and disposal.

The technical feasibility of a given treatment, storage, or disposal method refers to its applicability to one or more waste streams generated by schools. For example, both on-site incineration and off-site incineration are technically feasible for solvent wastes with high thermal content. Economic feasibility refers to the economic viability of applying a given treatment, storage, or disposal method to school wastes, given the quantities of waste generated and the nonprofit nature of a school. For example, a school generating relatively small amounts of solvent wastes will not find it economically feasible to build and operate an on-site incinerator. Off-site incineration may be economically feasible for some schools. In several regions, there is only a 20- to 30-percent cost differential between incineration and landfilling. Processing facilities that break down lab packs and combine treatment, incineration, and landfilling methods to provide the best disposal method for each chemical waste are frequently competitive with landfills (American Chemical Society 1987).

All of the treatment, storage, and disposal methods discussed in this section are generally available in the hazardous waste management industry. A school may determine availability of a method from known past use by schools or, in the case of an off-site method, from the existence of commercial facilities willing to provide the specific service. For example, on-site incinerators are considered available if there are instances where schools of similar size and nature have built and currently operate their own on-site incinerators to dispose of their waste. However, the availability to schools of off-site incinerators depends on the willingness of such facilities to accept wastes.

The feasibility of treatment, storage, or disposal methods and their availability to a school are largely determined by the location of the treatment, storage, or disposal facility relative to the point of waste generation; the types and quantities of waste generated by schools; and the relative costs of treatment, storage, or disposal methods. A school generating relatively small amounts of hazardous waste (100 to 1,000 kg per month) may only find it economically feasible to use a commercial hauler to ship the waste off-site after accumulating it on-site. However, extended on-site accumulation may require the school to apply for a storage permit. Some schools may find it too costly to apply for permits to store wastes and to satisfy the storage requirements.

The nonprofit nature of most schools in the United States may contribute to difficulties in accumulating the necessary funds to purchase expensive equipment, such as a hazardous waste incinerator, thus decreasing the likelihood of on-site treatment, storage, and disposal methods. As such, they cannot legally make or distribute profits. Typically, schools do not raise money in the traditional financial markets (bonds and stocks), but rather through other channels (for example, public funding, tuitions, endowments). Schools that are publicly funded or that receive small endowments may be subject to tight budgetary constraints that would make it difficult for them to undertake relatively capital-intensive waste management projects.

4.2.1 Accumulation and Storage

On-site accumulation and storage of hazardous waste are necessary steps in waste management when wastes cannot be treated or disposed of immediately. Accumulation and storage are followed by treatment and disposal, either on-site or off-site. Accumulation is allowed without a permit, provided that certain conditions are met (see Section 2.2.1).

Some schools may want to store waste beyond the allotted time to accumulate enough hazardous waste for a more economical shipment off-site for treatment or disposal, and they should apply for a Part B hazardous waste permit for storage. A Part B permit allows a school to store wastes longer than the allowed 90, 180, or 270 days and make fewer shipments. For example, New Mexico State University has applied for a Part B permit to store wastes for longer than 90 days and effectively reduce shipping costs (American Chemical Society 1984).

In contrast, a school generating relatively large quantities of hazardous waste (for example, more than 1,000 kg per month) may find it more economical to do without a storage permit and to ship the waste every 90 days or less. Although shipping costs would increase because of more frequent shipping, the generator could save time and money by being subject to the less stringent storage requirements of 40 CFR Part 262, compared with the Part B hazardous waste permit requirements. In addition, storing waste for shorter periods of time would decrease the opportunity for containers to leak, decreasing the potential for incurring costs to clean up releases.

4.2.2 Transportation

4.2.2.1 On-Site

On-site transportation at educational institutions is the movement of hazardous waste from one campus building to another building, where either both buildings are on the same contiguous piece of property or both buildings are separated by a public highway and the waste is shipped directly across the road. The main reason for transporting waste on-site is generally to accumulate and store it in one or more centralized locations. Neither EPA nor DOT regulates on-site transportation of hazardous waste by generators or by owners or operators of permitted hazardous waste management facilities (40 CFR 260.10).

4.2.2.2 Off-Site

Off-site transportation of hazardous waste is its movement from the point of generation to an off-site location for treatment, storage, or disposal. In all of the Tufts University case studies (1987), off-site transportation was by licensed transporters. In general, schools do not transport their hazardous waste off-site themselves, and therefore they are not required to obtain any license or permit to transport the waste. Schools must, however, comply with generator regulations under 40 CFR Part 262.

The Tufts University researchers found that off-site transportation by a licensed transporter was either through a contract (continuing or one-time arrangement) between the school and the transporter or by some form of centrally initiated and managed episodic cleanout operation ("amnesty days," "operation clean sweep," or some other program similar to household hazardous waste cleanouts). Frequently, transporters used by high schools were selected by State agencies. A common practice in shipping waste off-site is to use lab packs to contain the waste for easy handling during transport. Off-site transportation can be costly to schools. To lower costs, a school may store its waste on-site for a time or arrange with other schools to have their wastes transported simultaneously.

4.2.3 Treatment

Chemical and physical treatment methods are means by which hazardous wastes are rendered less hazardous before transport and disposal or more amenable to recycling and recovery.

On-site treatment methods applicable to schools include elementary neutralization and distillation. Schools should check with the appropriate regulatory agencies to inquire whether such activities are allowed. Normally, elementary neutralization and treatment that is recycling, such as distillation to recover solvents, are exempt from regulation. Also, on-site treatment in accumulation tanks is exempt from permitting, unless the treatment method is specifically regulated in a subpart of 40 CFR Part 264 or 265 (for example, thermal treatment). For wastes that are hazardous only because of their corrosivity, neutralization is a simple means of rendering them nonhazardous. Such wastes usually can be neutralized at the laboratory bench and then flushed down the drain. The procedure is simple and inexpensive, and it does not require a permit. As long as care is taken to perform the initial mixing slowly, neutralization is not a hazardous procedure. For laboratories that use solvents of known composition routinely, the costs of recovering the solvents by distillation may be less than the costs of purchasing new solvents and disposing of the used solvents. The cost advantage of solvent recovery, however, must be weighed against certain drawbacks, such as quality of the solvent recovered (for example, if top quality is required) and availability of the solvent when needed (for example, if the solvent is required for scheduled laboratory experiments).

Several treatment technologies for hazardous wastes are available, or potentially available, in mobile treatment units. These include incineration, infrared destruction, and several chemical reaction technologies. EPA has recently reported on these technologies, their permitting, and their use (EPA 1986c). As applications, costs, and permitting issues are developed and resolved for mobile treatment units, schools should be aware of and consider their potential use (Tufts University 1987).

All schools in the Tufts University study (1987) contracted for off-site treatment of at least part of their hazardous wastes. Both high school and college shops used commercial services that recycled degreasing and cleaning liquids in tanks. This practice substantially reduced the amounts of spent solvents that previously had to be disposed (Tufts University 1987). Several major universities had formal or informal policies encouraging reliance on off-site facilities. The motivation cited by university staff for selection of off-site facilities was the avoidance of problems. In such cases, cost considerations were distinctly secondary to concerns about the adequacy and safety of on-site practices and liability exposure.

Although there are many treatment facilities and recyclers nationwide, off-site treatment can be expensive. Because the volume of hazardous wastes from schools is relatively small, companies in the hazardous waste business do not find it profitable to serve educational institutions. Consequently, these companies tend to charge relatively high prices to accept wastes from schools (many companies have minimum charges). Also, the diversity of waste composition from educational institutions presents a major problem for waste management contractors, which sometimes refuse to serve educational institutions precisely for this reason (Ashbrook and Reinhardt 1985).

4.2.4 Incineration

Incineration, or controlled combustion at high temperature, is an effective destruction method for virtually all organic compounds as well as for some wastes that contain inorganic substances. Incineration significantly alters the composition of wastes, usually generates ash that must be disposed, and has air pollution potential. It has been designated by EPA as the best demonstrated available technology to manage many wastes (for example, 40 CFR 268.42(a); 51 *FR* 40616 (November 7, 1986); 52 *FR* 25763, 25770, and 25772 (July 8, 1987); and 53 *FR* 31153, 31154, 31155, 31157, 31160, and 31169 (August 17, 1988)). The specific incinerator requirements vary, depending on the specific situation, and are an integral part of the procedure for granting permits (National Research Council 1983). Incinerators used for destruction of hazardous waste must have EPA permits. The granting of an EPA permit is contingent on a demonstration by trial burn tests that the incinerator meets EPA performance standards.

The Tufts University researchers found that the incinerator at Stanford University would handle up to 1,000 pounds of solid and liquid wastes per hour at a construction cost of about $850,000, including the cost of a wet scrubber and instrumentation. Permitting is a complex and expensive process, and skilled staff are required to operate an incinerator. Thus, on-site incineration may be economically feasible for only the largest institutions. Despite the difficulties, a few large schools, such as the University of Wisconsin and the University of Arizona, already have installed waste incinerators on or near their campuses. The University of California is considering the possibility of building several regional incinerators to destroy the hazardous wastes from its numerous campuses. Several large schools have expressed strong opposition to on-site treatment because of on-site risks and problems and have indicated a preference for commercially provided (off-site) treatment and disposal services.

Off-site incineration is an effective treatment method for almost all organic compounds. Some waste disposal services will pack the laboratory waste and arrange for its transportation and, as appropriate, for incineration or disposal. In some cases, commercial incinerator operators may be willing to accept school laboratory wastes. However, many commercial incinerator operators do not accept unsegregated waste or waste packed in fiber drums, such as lab packs (National Research Council 1983). Incineration costs tend to be higher than disposal costs. However, as new regulations concerning disposal in landfills take effect, land disposal costs will increase and make incineration more attractive. A number of schools have selected off-site incineration as the method to manage their waste. As with selection of off-site treatment, this was motivated more by concerns about adequacy and safety of on-site practices and liability exposure than by cost considerations (Tufts University 1987). To reduce the potential for future liabilities associated with environmental releases, schools must ensure that their wastes are being handled by permitted facilities with good operating procedures and compliance records. Schools should contact State and local agencies to check on the permit status and compliance records of commercial incineration facilities.

4.2.5 Disposal

Current on-site disposal of hazardous waste at educational institutions includes disposal in an on-site landfill or direct discharge (of liquids and sludges) into sanitary sewers through laboratory sinks and similar connections ("drain disposal"). To construct and operate an on-site landfill, a school must obtain a Part B hazardous waste permit. The landfill must conform to EPA regulations, and can accept only certain wastes because EPA has established a ban on liquids in landfills and other restrictions on the land disposal of certain hazardous wastes. Drain disposal must satisfy requirements set by State and local agencies for discharge into publicly owned treatment works.

Although the the technology for constructing and operating landfills that meet regulatory design requirements is available, schools generally would not be attracted to this form of on-site disposal for several reasons, including the following:

- Recent and ongoing regulatory developments aimed at limiting, to the maximum extent possible, the reliance on land disposal of hazardous waste

- Relatively high costs of permitting, construction, operation, closure and post-closure care, and financial assurance requirements

- Mounting public opposition to landfill siting due to the potential for future releases from the disposal site (for schools, public opposition is likely to be compounded by public perception that schools should not be in the business of disposing of hazardous waste)

Drain disposal is technically feasible, provided that the waste satisfies certain requirements for physical form (for example, liquids and certain sludges). If a school expects to discharge to publicly owned treatment works certain wastes in amounts that exceed threshold values, it may be required to apply for a discharge permit or to pay certain fees, which can be costly. Indications of widespread drain disposal were observed in the Tufts University study (1987). Again, drain disposal is neither illegal nor improper if it is performed in conformance with State regulations and the receiving wastewater system's requirements. However, there was no evidence that the smaller case study schools were aware of these requirements or had established that their practices satisfied these requirements. From the general absence of central oversight and control in the smaller case study schools, the Tufts University researchers concluded that the existence or extent of the practice was unknown to school administrators (Tufts University 1987).

Off-site disposal of hazardous waste includes disposal in an off-site landfill, a surface impoundment, a land treatment unit, or a waste pile. The hazardous waste regulations currently ban the disposal of bulk liquids in landfills unless they have been stabilized. The regulations restrict the disposal of containerized liquid hazardous wastes in landfills, and also impose strict restrictions (for example, treatment standards) on the land disposal of many solvents and other hazardous wastes. Schools must be aware of and satisfy these requirements when they ship waste to off-site facilities for land disposal.

In the future, land disposal of hazardous waste will be further restricted, and schools may no longer be able to ship any of their waste directly for off-site land disposal. For example, by the end of 1988, if a school generates a listed solvent waste prohibited from land disposal, it must ensure that the waste meets certain standards before land disposal of the treatment residuals. Land disposal of the solvents themselves is restricted under the land disposal restrictions program. In general, simply packaging in lab packs for direct off-site land disposal is no longer feasible unless the waste satisfies the current criteria for land disposal. Lab packs may be land disposed if restricted wastes are removed before land disposal, the wastes meet the treatment standard, or the no migration petition under §268.6 has been successful (51 FR 40585, November 7, 1986). However, given the ban of solvents and other wastes from landfills, generators of greater than 100 kg of hazardous waste per month will have to investigate recycling or incineration as management options for all of these wastes.

CHAPTER 5

POSSIBLE WAYS TO IMPROVE MANAGEMENT OF HAZARDOUS WASTES FROM EDUCATIONAL INSTITUTIONS

As stated in Chapter 1, the recommendations made in this chapter are factual in nature. EPA was not directed by the law to develop recommendations for regulatory or statutory changes. Therefore, this chapter does not recommend any regulatory or statutory changes. This chapter discusses potential solutions to hazardous waste management problems: how individual schools can better manage hazardous waste (Section 5.1), programs that can be developed among schools (Section 5.2), the type of guidance that EPA, the States, and others may provide (Section 5.3), regulatory changes that EPA has made or proposed to make (Section 5.4), and regulatory and statutory changes recommended by commenters (Section 5.5). Section 5.6 presents conclusions.

5.1 SOLUTIONS WITHIN SCHOOLS

It appears that the key to managing hazardous wastes in secondary schools, colleges, and universities is to increase school administrators' and faculties' awareness of safety procedures and proper disposal methods for chemical wastes. Ashbrook and Reinhardt (1985) state that no matter what quantity of hazardous waste is generated, it is the responsibility of schools to train their students in proper management techniques when dealing with chemicals. Health and safety programs could publicize the hazards associated with chemicals and aid in waste reduction and disposal programs.

Teachers, professors, and instructional and other personnel at all levels of education who handle hazardous waste should be instructed in the proper methods of hazardous waste handling and disposal, recordkeeping, and hazardous waste reduction. This instruction should occur both as a part of original training to qualify to teach or to perform a job and also in any continuing education courses. For example, the Council of State Science Supervisors (1984) encourages teachers at secondary schools not to use potentially carcinogenic compounds. Also, the Michigan State Department of Natural Resources is implementing a program designed to inform individuals working at schools with classes from kindergarten through grade 12 about the hazardous waste regulations (Peck 1987). Its program is designed to ensure that schools follow proper waste disposal practices and, if they do not, to provide training. Schools could use their waste management program to teach students proper waste handling.

To manage hazardous waste successfully, a school must recognize that it uses or generates materials that can be classified as hazardous. A school must be committed to allocating sufficient funds and staff to deal with its hazardous waste management problems. This includes establishing and maintaining hazardous waste management programs. A waste management program should educate people about what constitutes a hazardous waste and how to dispose of it properly. Similarly, information on handling, storage, and packaging requirements should be available through this program. The level of commitment varies among schools, depending on size and type. Clearly, schools with larger research programs generate more hazardous wastes and need more extensive programs. To make the most of limited funds, a school may find it more cost-effective to educate and use its maintenance workers under existing organizational structures rather than to introduce a new organizational structure solely to manage hazardous waste. As procurement and liability costs increase, schools affected have seen the need to staff and fund waste management programs adequately. These programs can be district-wide in the case of secondary schools, can be made up of a consortium of schools that pool information and resources for disposal, or can be run by a large university that acts as a treatment, storage, or disposal facility for smaller schools in the area.

5.1.1 Waste Identification

The central issues in hazardous waste identification are the following: When does a material become a waste? What makes a waste a *hazardous* waste? School personnel need to segregate wastes, such as solvents, and identify and record on a list the wastes placed in the waste containers. This would then allow the health and safety coordinator to look at this list and determine how the wastes can be disposed (Ashbrook 1986). School laboratories should require that wastes be labeled. This is true for both teaching and research situations. If unlabeled wastes accumulate, a cooperative program within a school could be instituted to have students analyze the wastes as part of a class project. This could limit the equipment that the hazardous waste management team would need, as well as teach students to identify wastes that they might not handle routinely. The type of laboratory analysis performed at a school may not completely identify whether a waste is hazardous, but might at least indicate when further analysis will be necessary.

5.1.2 Handling and Collection

If a school does not have a centralized waste management program, as may be the case in many smaller schools, wastes are likely to accumulate in individual laboratories. This can result in the need to have a regular, periodic 1-day cleanout of the school. In this instance, a waste handling firm can be contracted to package and dispose of the wastes, thereby removing the handling and collection problem from the school. Proper labeling of chemicals is important to avoid large analytical costs.

Larger schools may need a more defined program. This can involve providing a protocol for placing wastes in certain types of containers and arranging for a weekly or monthly collection of these wastes. This type of program requires cooperation between those generating the wastes and those collecting them to ensure that wastes are placed in containers with compatible wastes. If waste collectors are informed of the type and quantity of waste, they can arrive with a container of the proper size with packing material to prevent breakage. Selection of packing material can be based on the type of wastes.

5.1.3 Storage and Packaging

Storage of materials involves the storage of newly purchased materials and the storage of waste or materials that are no longer usable. An educational institution can collect the waste generated from several departments and accumulate it up to the time limits allowed under the hazardous waste regulations to maximize the amounts of waste disposed at one time. This minimizes the number of collections, thus keeping disposal costs as low as possible. However, a school must be aware of the risks of storage when considering such a program.

In secondary schools and small colleges and universities, it may not be possible to have this type of system. At larger schools, storage areas range from a small room (Larson 1986) to a converted mobile home (Meister 1981) to an entire building (Sanders 1986). Proper recordkeeping also is necessary for such a program. Schools could improve their tracking of hazardous waste generation by implementing an internal manifesting system for on-site transport. This approach has been successful in facilitating waste classification and determining waste generation rates at several EPA facilities. Schools can voluntarily (but EPA does not require them to) implement an internal manifesting system. However, this does not relieve them of the requirement to prepare the current manifest for off-site transport.

The packaging required for storage may be tanks, 55-gallon drums, or other containers that are compatible with the waste to be stored. The method for disposal will also influence the type of packaging. For example, a fiber drum can be used to store and package wastes destined for an incinerator. Lab packs or small containers can be used for storage of small quantities of wastes. If wastes are segregated by their properties, the storage area and number of containers needed can be reduced (Ashbrook and Reinhardt 1985).

5.1.4 Transportation

Spill prevention and safety assurance require that trained personnel be involved and that they use proper containers. Containers should be resistant to accidental breakage or opening whether they are hand-carried, carted, or moved by vehicle. Off-site transport of hazardous waste is regulated both by EPA under 40 CFR Parts 262 and 263 and by DOT under 49 CFR Parts 171-179. If the school is connected by public roadways, then the school must comply with DOT regulations. A school may need to have several storage areas with separate pickups for a transporter so that public roadways do not have to be traveled to take wastes to storage. On-site transport is not regulated by either EPA or DOT, but care should be taken to prevent spills and to keep track of all wastes.

5.1.5 Treatment

Physical and chemical treatment can render wastes less hazardous, thereby facilitating their recycling or disposal. These activities should be in compliance with applicable Federal and State regulations. Methods commonly used are neutralization and distillation. These treatment techniques are effective and can be performed in schools; in some instances, they can be incorporated into teaching laboratory experiments. Advantages to treatment are low energy requirements, usually permanent effects, and reduction in the volumes of most wastes; disadvantages are the limited usefulness of treatment methods and the fact that each waste needs a specific treatment method. Neutralization of some wastes can be performed before drain disposal. This type of procedure can be performed as part of an experiment. Acids or bases are generally treated in this manner.

Distillation and recovery of chemicals (for example, solvents) from wastes is another treatment option, but there is no clear consensus on the practicality or advantages of having a distillation facility at a school. At the Massachusetts Institute of Technology, for example, the administration encouraged the practice, but faculty and research staff resisted it (Tufts University 1987). It is considered an appropriate practice where the volume of wastes available for such treatment warrants a central facility with one or more batch stills and its own management. Still bottoms might constitute hazardous wastes, but the volumes to be shipped off-site would be reduced.

Schools also can treat some laboratory wastes by biological methods (National Research Council 1983). Biological treatment is especially useful for phenols, alcohols, aldehydes, ketones, and wastes from life science laboratories. Biological treatment can be performed on a small scale. Under RCRA, such treatment is allowed without a permit, but only in tanks. Discharges of wastewater from any treatment process to the Nation's surface waters are subject to regulation under the National Pollutant Discharge Elimination System (40 CFR Part 403) or, if discharged to the sewer, to local requirements for publicly owned treatment works.

5.1.6 Incineration

Incineration is an effective destruction method. It can be used for almost all combustible liquid, semisolid, and solid wastes. A number of schools operate incinerators; some are dedicated to biological wastes, such as animal carcasses, and others are used for chemical wastes (Sanders 1986). This method, however, is only available on-site to schools that have a large commitment of funds to construct and operate an incinerator safely, which puts the method beyond the reach of most educational institutions. Hazardous waste incinerators must be permitted under RCRA, an extremely lengthy process.

5.1.7 Disposal

Educational institutions can dispose of hazardous wastes on-site by direct discharge into sanitary sewers through laboratory sinks (drain disposal) or off-site in a landfill, surface impoundment, land treatment unit, or waste pile. Disposal of hazardous wastes into a sewer system is subject to CWA regulations (40 CFR Part 403). Schools should check the restrictions for their local publicly owned treatment works. RCRA regulates the storage and disposal of hazardous wastes before drain disposal. Hazards that must be guarded against when using drain disposal range from reactions in and corrosion of the plumbing system to adverse effects on the receiving waters. Chemicals can be treated adequately or diluted before introduction into the sewer system. Clearly, care should be taken to prevent incompatible mixtures from being formed; only water-soluble or water-miscible substances should be disposed and highly toxic or combustible substances should not be disposed by this method. Land disposal of hazardous waste is allowed only under a RCRA permit; this will be impractical for the vast majority of schools.

5.1.8 Recordkeeping

The regulations require that each waste be tracked from the time it is generated through storage, transport, and disposal. The recordkeeping requirements increase disproportionately relative to waste volume because of the numbers of wastes that educational institutions generate. Under current regulations, there is no simple way schools can adapt to this situation, but individuals who generate wastes should be encouraged to provide the maximum amount of information possible on identification of the wastes and volumes produced.

5.1.9 Waste Reduction Strategies

Educational institutions have the greatest control over prevention and reduction strategies in managing hazardous wastes. It is within the scope of faculties' and administrators' activities to minimize the exposures of students and workers to hazardous materials and to minimize the amounts of hazardous waste generated. As secondary school administrators and teachers become aware of the potential hazards experienced, a move is under way to reduce the amount of hazardous waste produced by substituting materials or canceling courses. For example, at one high school visited by Tufts University researchers during their study (1987), they found that substitutes for hazardous materials were used in chemistry classes. In the electronics course, etching was no longer performed because of the hazards associated with the use of ferric chloride and hydrochloric acid. Substitution of less hazardous materials in classroom experiments and the reduction of the scale of experiments are approaches that have been encouraged (Council of State Science Supervisors 1984, Sanders 1986). Some cleaning agents can be replaced (for example, detergents may sometimes be used instead of chromic acid or alcoholic potassium solutions).

Possible means of reducing the amounts of hazardous wastes generated by laboratories include using interactive computer simulation models rather than actual chemical reactions in instructional laboratories and substituting less hazardous or nonhazardous chemicals. Educational institutions can reduce waste generation by minimizing the quantities of chemicals that they purchase and store and by recycling. The applicability of the following educational suggestions will depend on the size of the institution. A centralized purchasing department can be helpful in coordinating purchases of the same chemical by several research or teaching groups. The purchasing department could also arrange with some principal investigators to purchase only parts of their requests if the quantities seem excessive, or it could arrange for only partial shipment, with the remainder shipped as needed. Such measures would reduce the quantities of chemicals needing storage at a school and might result in fewer chemicals exceeding their useful lives. When disposal costs are added to the purchase prices of chemicals, it may be more expensive to buy large quantities. Schools must maintain inventories of chemicals and rotate stock, using older chemicals before their shelf lives expire. These inventories are invaluable in organizing chemical exchange and reuse programs among different departments in institutions. An advantage of a centralized waste-handling area is that materials no longer needed by one laboratory group may be of use to another. This is termed "waste exchange," a form of recycling. Recycling programs of this type are operated at a number of schools, as was discussed in Section 3.4.3 of this report. Ashbrook and Reinhardt (1985) have reported that these programs can save thousands of dollars. The existence of a centralized waste-handling area means that the school administrators have committed space in which to store the wastes. Duplicate purchases of chemicals may be reduced by circulating inventory lists to different departments. Under EPA rules, unused commercial chemical products recycled in this manner are not solid waste until intended to be discarded.

Educational institutions can reduce the volume of solvents involved in cleaning glassware by reusing solvent for the initial cleaning and using fresh solvent only for final cleaning, thus decreasing the amount of clean solvent required. In some cases, solvent wastes can be distilled and reused for classroom experiments or as thinners and degreasers by the maintenance department. Some metals can be recovered in the laboratory (for example, mercury can be recovered by filtration in a fume hood, and silver can be recovered from photographic solutions by electrolytic techniques). These activities must be in compliance with applicable Federal and State regulations, but EPA rules currently do not apply to recycling devices (only to storage tanks or containers used prior to recycling).

A necessary element in a prevention program is to identify materials that can become or are hazardous. If a chemical is known, the regulations will indicate whether it is considered hazardous. Research laboratories often synthesize new chemicals, and they must determine whether the chemicals are hazardous and how best to handle them. The safety issue is not always addressed in discussions of hazardous waste; attention to safety may increase the level of awareness and could prevent or reduce waste generation. The knowledge of how best to handle chemicals can help students, faculties, and staffs to substitute less hazardous materials, scale down experiments, and minimize spills and improper disposal.

Other school operations (for example, vocational shops and maintenance operations) also can minimize their wastes by using similar techniques, such as reusing solvent for the first round of cleaning of paintbrushes and spray guns. Paint wastes from spray painting can be reduced by selecting the correct air pressure and following certain recommended procedures. HSWA mandated that the generation of waste be minimized. The easiest way to reduce waste volume is to not generate it in the first place. Appendix C contains more details on waste minimization techniques.

5.2 SOLUTIONS AMONG SCHOOLS

Problems can be reduced through cooperative programs among schools to exchange information, reduce the amount of waste generated, and manage the waste generated.

5.2.1. Information Exchange

Information exchange programs can help secondary schools and small colleges and universities learn which wastes are hazardous and the methods available to minimize the use of hazardous materials in the classroom. An informational program can aid both in recognition of the problem and in developing handling capabilities. Tufts University (1987) reported that some larger universities have prepared comprehensive handbooks for their chemical users and waste generators. These handbooks could be made available on request to smaller schools, for a small fee. Yale University provides consultations to schools setting up waste management programs (Tufts University 1987).

5.2.2 Collective Waste Handling and Recycling Programs

Collective programs could include the handling, collection, treatment, transport, incineration, or disposal of hazardous wastes. The viability of such a program would depend on schools being in close proximity, such as within a secondary school district or a county or region of a State. One disadvantage of a cooperative program is that transportation regulations must be considered more carefully. Also, if a central facility receives waste from a generator that is not conditionally exempt, the central facility must have a RCRA storage permit. (An exemption is made for transfer facilities where waste is consolidated, and the waste is stored in containers approved by the Department of Transportation for 10 days or less (see 40 CFR 263.12).)

The State of Minnesota has developed the Minnesota Chemical Waste Assistance Project, which serves 160 high schools and 20 colleges throughout the State. The project has five regional centers to which participants periodically bring their wastes, which then are shipped to the University of Minnesota for handling. This program also has a component that allows schools to obtain chemicals from schools that are seeking to get rid of them. This program enables participants to dispose of wastes at a relatively small cost and helps to reduce the quantities of materials that accumulate at individual schools (Sanders 1986).

Contracting with a waste handler could also be administered cooperatively. This could allow for schools to dispose of their wastes collectively, reducing the costs, and it could be accomplished in either of two ways:

- By storing materials first in a regional facility similar to that in the Minnesota project and, when enough material has been accumulated, having it removed by a waste handler or

- By contracting with a waste handler to package and remove wastes from all the individual schools in a given area.

5.2.3 Incineration

Incinerators are too expensive for smaller schools to install and maintain. It could be possible, however, for several schools within a small geographic area to cooperate to install an incinerator for their joint use. The University of California has been investigating the possibility of installing several regional incinerators to destroy wastes generated at its campuses (Sanders 1986). It should be noted, however, that incineration can be conducted only under RCRA interim status or a full RCRA permit.

5.2.4 Prevention and Reduction Strategies

A number of colleges and universities have had success in managing recycling programs that take waste or unused chemicals to central locations, where they are then made available to researchers who need the chemicals. (An important point to consider is that the commercial chemical products listed in 40 CFR 261.33 are not wastes if they are reused for their originally intended purposes, even if the reuse is not by the original purchaser.) Recycling programs could be expanded to include several schools in a geographical area to reduce wastes collectively (Sanders 1986). Lists of available chemicals could be exchanged among participating schools. The advantages of such a program are the savings both in purchasing and disposal costs. A disincentive could be the need to transport chemicals from one campus to another, which requires compliance with the transportation regulations. This can be true even if the chemicals are not hazardous wastes, because DOT regulations apply to hazardous materials, a broader universe than EPA's list of hazardous wastes.

Secondary schools can work within school districts to standardize curricula and ensure that all science courses use the same chemicals. This would not necessarily reduce the quantity of hazardous waste generated, but it would make disposal of the waste easier from the school district's point of view because the quantities of any particular type of waste generated would be larger and of more consistent composition. As part of the curriculum changes, less hazardous materials also could be substituted into the experiments, which would reduce the quantity of hazardous waste generated.

Colleges and universities operate more independently than do public secondary schools. Even within State-run university systems, each campus generally has its own administration. As a result, changes in curricula come from within individual departments rather than through cooperative agreements. However, there are some colleges and universities within the same areas that have cooperative agreements so that students can take courses at any school. Within this type of arrangement, a course could also be taught at only one school to minimize the quantity of waste generated and to restrict the waste to one location.

5.3 GUIDANCE FROM EPA, THE STATES, AND OTHERS

This section suggests ways that guidance from Federal and State agencies and others can aid educational institutions in the management of hazardous waste.

5.3.1 Information Exchange

State agencies could collaborate with educational associations to develop programs that could include the following:

- Increasing awareness of those activities within schools that generate hazardous waste, including those not associated with the science department
- Providing instructions and procedures for identifying hazardous wastes (including all wastes generated by conditionally exempt schools)
- Developing appropriate management guidelines, including source reduction, recycling, and reuse
- Establishing safety procedures and emergency response measures

Such programs should be useful to high schools and smaller postsecondary institutions. Delivery mechanisms, including workshops and incorporation into college-level and continuing education curricula, may require some State funding.

5.3.2 Centralized or Collective Programs

Technical advice and assistance programs could be developed at the State and local levels to aid concerned educators and administrators in developing and auditing waste management programs. (Waste management programs are sometimes reviewed periodically, by either those administering them or those overseeing their progress, for effectiveness, cost, and other factors.) Representatives from regulatory agencies, consultants, and faculty and staff of major universities could be selected to form advisory committees to aid in the establishment of effective hazardous waste management programs. Advisory committees could be formed and funded by State education departments. Computerized bulletin boards, newsletters, and regional conferences could be developed under these programs to help schools develop waste management programs. State-wide or regional hazardous waste packaging and transportation programs could be organized to provide regular service to schools. The organization could be a collaborative effort of State regulatory and education agencies and waste transporters, assisted by chemical suppliers and educational associations.

In addition to collective waste disposal programs, the collection service could include informational programs to inform educators about waste handling and waste minimization. Methods of waste storing and packaging also could be discussed to enhance waste generators' understanding of the regulations.

5.3.3 Guidance Manuals on Handling Hazardous Wastes

In recent years, a number of publications have appeared that can be used by educational institutions to improve their hazardous waste handling programs. A few of them are highlighted below.

5.3.3.1 Federal and State Manuals

EPA has prepared a reference guide that provides small quantity generators with the information that they need to obtain an EPA identification number and to complete Uniform Hazardous Waste Manifests (EPA 1986b). The manual provides information for educational institutions on which wastes are considered hazardous and on how to comply with the transportation regulations. EPA has also developed some waste minimization information, included as Appendix C of this report.

The National Institute of Environmental Safety and Health has been mandated under section 209 of the Superfund Amendment and Reauthorization Act of 1986 to develop an educational training program for hazardous waste workers. It is possible that this manual will include information that would be useful to schools, such as methods for in-house handling, treatment, and storage.

A videotape (22 minutes) produced by EPA in 1987, entitled *Lab Compliance with RCRA*, gives bench chemists and laboratory technicians a better understanding of what they must do to comply with the hazardous waste regulations. Members of the public can borrow copies of this videotape for 2-week periods. For further information, contact Rolf Hill, Training Officer, U.S. Environmental Protection Agency, Office of Waste Programs Enforcement, 401 M Street, SW (WH-527), Washington, DC 20460, (202) 475-7037.

The New York State Environmental Facilities Corporation (1985) has prepared an informational guide on how secondary schools can manage hazardous waste. The manual identifies problems related to waste management and describes how to develop a safety and management program.

5.3.3.2 Other Manuals

The Council of State Science Supervisors (1984) reviewed high school science curricula to identify which chemicals should be removed from use. State educational agencies could combine the list that the council has compiled with suggestions of other hazardous materials that could be removed from curricula. A handbook could be developed that would include the following:

- Hazardous materials that should be removed from use in the curricula and alternatives that could be used

- Treatments that could be performed after experiments to render hazardous materials nonhazardous

- Instructions for labeling all containers of substances used or generated in experiments in compliance with RCRA regulations

The National Research Council (1983) published *Prudent Practices for Disposal of Chemicals from Laboratories,* which can serve as a guide to faculties of secondary schools, colleges, and universities. The book discusses all aspects of waste handling and disposal. It also presents Federal regulations that were promulgated before 1983.

Various guides issued by associations of waste generators and waste management companies recommend (to ensure safety and minimize risk) that on-site transportation of hazardous waste be performed only in authorized vehicles by trained personnel. (Temporary storage in or near the laboratory may be used to help minimize the number of trips necessary to transfer the waste to a central storage location (Tufts University 1987).)

Two publications by the American Chemical Society, *Less Is Better* (1985) and *RCRA and Laboratories* (1986), discuss waste minimization and Federal regulations that apply to laboratories. Both discuss waste management strategies and compliance with RCRA regulations.

5.3.4 Regulatory Guidance

Regional forums, consisting of representatives from EPA, State environmental agencies, and educational institutions, could be convened to discuss regulatory ambiguities and to formulate a guidance document for regulatory personnel to deal with schools. Representative participation and consensus building in these forums is critical. Topics for which regulatory interpretation and practical guidance would be useful to schools and regulatory personnel include the following:

- Hazardous waste identification and classification, including transition from supply to waste status
- Effective measures for encouraging recovery and recycling in schools without compromising safety and without conflict with accumulation and storage requirements
- Definition of "on-site" as it applies to educational institutions, the tradeoffs between multiple accumulation locations and central storage, and appropriate transportation containers and systems for use in schools
- Management of incorrectly identified wastes upon return to a school or rejection by a transporter
- Establishment and operation of waste treatment procedures and facilities by schools in various categories and with varying permit status

EPA, if resources are available, could perform the following activities to educate the schools and universities about hazardous waste regulations and about proper methods for handling and disposing of hazardous waste. With the assistance of the States and educational institutions, EPA could prepare a guidance document on hazardous waste management at schools similar to the one that it developed for small businesses. An EPA guide would help to inform educators about existing hazardous waste management regulations. Tufts University (1987) and others (Sanders 1986, Ashbrook and Reinhardt 1985) have found that the major problem within educational institutions is a lack of understanding about which regulations apply to schools and how to implement them. EPA could sponsor an educational program for hazardous waste handling and disposal by entering into a cooperative effort with the States to gather a list of wastes and their designations from the large schools and universities. This information could be shared with smaller colleges and secondary schools. The list could be updated on a regular basis.

The American Chemical Society (ACS) has suggested that EPA establish an independent office to assist academic waste generators with cleanup problems (ACS 1987). ACS believes that the safest approach for most laboratory spills is expeditious handling by those individuals in the laboratory most knowledgeable about the specific reagents or reaction products involved. However, in the event of a spill or other environmental incident at an educational institution, the responsible individuals may not have the expertise to select the most cost-effective and environmentally sound cleanup method properly. If they are required to take corrective action and not to have the EPA perform the cleanup, they need access to sound advice regarding options. An independent office, perhaps the EPA Small Business Ombudsman, could be made available to advise schools on various cleanup alternatives.

5.4 REGULATORY CHANGES EPA HAS MADE OR PROPOSED TO MAKE

EPA already has made or proposed to make the following regulatory changes that could alleviate problems with hazardous waste management at educational institutions. First, EPA has issued small quantity generator requirements that are more tailored to such generators. Many schools are small quantity generators. Second, EPA has exempted from regulation small quantities of hazardous waste, when evaluated in treatability studies. Third, EPA has proposed reducing permitting requirements for small quantity burners.

5.4.1 Permitting

In the past, facilities and laboratories, including university research facilities, presently are restricted from conducting treatability studies (40 CFR 270, "Hazardous Waste Permit Program") unless they are permitted, have interim status or have a research, development, and demonstration permit (§270.65). Under recent amendments to §261.4, however, small quantities of hazardous waste are exempt from regulation when such quantities are being evaluated in treatability studies. Facilities conducting treatability studies will be exempt from RCRA permitting requirements if they meet specific quantity limitations for storage and treatment rates. The treatability studies sample exemption will allow research facilities at universities to conduct small-scale treatability studies without obtaining a research, development, and demonstration permit (§270.65).

In the preamble to the final small quantity generatory rule (51 FR 10146, March 24, 1986), a commenter suggested that EPA could reduce permit requirements for all treatment activities at small quantity generator sites. The Agency's response was that when these generators are conducting the same treatment and storage or treatment and disposal as other permitted facilities, their on-site treatment activities pose a potential risk to human health and the environment. Therefore, reduced or eliminated permitting requirements would be inappropriate. The Agency went on to explain that no permitting would be required if a generator chooses to treat its hazardous waste in its accumulation tanks or containers in conformance with the requirements of §262.34 and Subparts J or I of Part 265. Nothing in §262.34 precludes a generator from treating waste when it is in an accumulation tank or container covered by that provision. Small quantity generators, which generate between 100 to 1,000 kg of hazardous waste per month, are not required to obtain interim status and a RCRA permit if the on-site management that they perform is treatment in an accumulation tank or container that is exempt from permitting during periods of accumulation (180 or 270 days).

5.4.2 Burning Hazardous Wastes

Under current regulations (40 CFR 270.62, "Hazardous Waste Incinerator Permits"), the cost of the permitting process for incinerators is prohibitive for most schools. Current regulations prohibit the burning for energy recovery of wastes that have usable fuel value without a permit (40 CFR Part 266, Subpart D). However, EPA has recognized that this situation could make it more difficult for small burners. Therefore, it has proposed, under Subpart D of Part 266, small quantity burner requirements that conditionally exempt from permit requirements those burners that burn between 7 and 300 gallons of hazardous waste per month on-site for energy recovery (52 FR 17035, May 6, 1987). Additional conditions include the following: the number of units at the site that burn the hazardous waste is limited, the burning must be on-site, dioxin-containing hazardous wastes may not be burned under this exemption, and the hazardous waste heat input rate is limited to 1 percent (by volume) of the total fuel input. For burners that are unable to meet the conditions for small quantity burners, permits still will be required and certain technical standards must be met.

5.5 SUGGESTIONS FOR REGULATORY REFORM

This section discusses areas of potential regulatory change that could ease the requirements to which educational institutions are subject. These comments were suggested by parties commenting on the draft of this report. EPA has not evaluated these suggestions, and thus the Agency is not recommending that these regulatory changes be made. In general, EPA could examine these options in the future. Discussion of these changes is generally divided by sections in the *Code of Federal Regulations*.

Both the States and the regulated community recommended the following changes:

- Clarify existing rules for small quantity generators as they apply to educational institutions
- Tailor existing hazardous waste management regulations to educational institutions, such as reexamining EPA's definitions of "on-site" and "off-site," and standardizing hazardous waste regulations nationally
- Reduce hazardous waste management requirements for educational institutions, for example
    (1) Changing the waste identification and recordkeeping requirements to simplify paperwork
    (2) Reducing permitting requirements for small scale incinerators to facilitate incineration as an economical treatment alternative
    (3) Allowing longer on-site storage of laboratory waste without a permit

Finally, the following suggestion would require statutory changes: allow land disposal of all lab packs, even those containing waste prohibited from land disposal. The Hazardous and Solid Waste Amendments of 1984 did not specifically exempt lab packs that contain prohibited waste from the land disposal restrictions regulations. If lab packs contain hazardous wastes subject to the land disposal restriction, they are prohibited from land disposal unless such wastes meet the applicable treatment standards. EPA cannot alter this requirement without statutory changes.

5.5.1 Definition of "On-Site"

As suggested by several commenters, EPA could reevaluate the definition of "on-site" (§§260.10 and 270.2) to address the problems of such generators as universities, which have numerous buildings on a campus, yet are unclear as to whether they should apply for one or several hazardous waste identification numbers. This could include changing the definition of "on-site" to allow educational institutions to collect hazardous waste from disparate geographic locations, up to 25 miles apart operated by the same institution.

5.5.2 Waste Characterization and Generation

Currently, 40 CFR Part 262 ("Standards Applicable to Generators of Hazardous Waste") requires that each chemical be reported by waste code and on the manifest by DOT shipping description. Part 268 ("Land Disposal Restrictions") requires wastes restricted from land disposal to have a notification or certification sent to the receiving facility, which includes an identification by waste code. Educational institutions have varied waste streams as a result of the large numbers of chemicals used and the variable quantities of waste generated. The National Research Council (1983) has prepared a simplified, seven-category classification scheme. These classes could be made uniform for EPA, Department of Transportation, and State requirements for schools. This system would allow all manifests and records to be based on these seven classes rather than on waste codes and would ease the schools' recordkeeping burden. The scope of this regulatory change would include allowing transfer, storage, and disposal facilities to accept wastes from educational institutions without detailed identification of every compound.

Current recordkeeping requirements are extensive because of the requirement for waste stream identification. If the simplified classification scheme discussed by the National Research Council (1983) were adopted, the aggregate waste name could be used for lab packs that are used to transport wastes off-site. The classification also could be used for on-site storage. Another classification system could group solvents according to flammability, by whether or not they are halogenated, and by other criteria. Simplified classification also would allow records to be simplified, because the quantity of each class of chemicals (not the quantity of each chemical) would be recorded. EPA cautions, however, that certain requirements (specifically, land disposal restrictions) are specific to waste codes, so there are limits to the amount of simplification possible.

5.5.3 Transportation

Intersecting public roads and noncontiguous boundaries between university property and other land, which are typical of an educational institution's geographical layout, make interpretation of the regulations (40 CFR Part 263, "Standards Applicable to Transporters of Hazardous Waste") difficult and make compliance costly. Therefore, many educational institutions may be transporting waste chemicals along city streets without EPA manifests and without the packaging required by the Department of Transportation (Ashbrook and Reinhardt 1985). Perhaps special exceptions could be made for small quantities of waste generated by schools. The American Chemical Society suggests that EPA allow academic facilities to transport their own hazardous wastes to central collection areas on their property under the following controlled conditions whether or not public roadways must be crossed:

- Development and maintenance of a transportation contingency plan
- Liability insurance to cover transportation
- Driver training in hazardous waste handling and incident response
- Development of route plans that minimize transport on public roads
- Use of Department of Transportation-specified packaging for the transportation of all hazardous wastes

5.5.4 Extended Storage

The American Chemical Society suggests that EPA allow on-site storage of laboratory wastes for over 90 days without requiring a treatment, storage, or disposal permit. Because educational laboratories frequently do not generate enough waste to facilitate economical transport to off-site facilities, a substantially higher cost per unit for transportation is required in comparison with industrial waste generators. Extended storage of quantities not exceeding one truckload (80 drums) of waste could allow academic generators to reduce these per unit costs to a reasonable level. If a time limit is necessary, 1 year could provide a more reasonable amount of time to accumulate economic quantities for shipment than do the present time limitations. Since laboratory wastes consist primarily of small quantities of chemicals in their original containers, the American Chemical Society does not expect that extended storage of these materials will present a significant safety problem when normal storage procedures are followed.

5.5.5 Other Regulatory Reforms

The following are other regulatory reforms suggested by various commenters on the draft of this report. According to the National Research Council (1983), EPA, DOT, State, and local regulations are inconsistent in some areas dealing with hazardous waste disposal. For example, some State or local regulations may have additional requirements. The National Research Council recommends "the establishment of a mutually consistent, interlocking regulatory approach among different agencies for handling and disposal of small quantities of chemically diverse waste that are generated by many laboratories." The advantage to a uniform set of regulations is that regional or national groups could be assembled to discuss methods of compliance. Consistent regulations would make it easier to provide guidance to educational institutions on a national level and would facilitate their understanding of the requirements. An example of the effectiveness of such an approach can be found in the development of EPA's Uniform Hazardous Waste Manifest, which combines many State forms and approaches into one. However, State hazardous waste programs can be more stringent than the Federal program. Thus, there is a limit to the amount of uniformity that can be achieved.

The American Chemical Society (1987) has suggested that EPA adopt a definition for "academic laboratories." If Congress mandates EPA to promulgate regulations for the management of hazardous waste from educational institutions, then the Agency could consider defining academic laboratories as follows:

> "Buildings and areas of buildings under the ownership and control of secondary and higher education institutions in which operations involving chemicals are carried out for the following purposes:
>
> "(a) Investigation of physical, chemical, and biological properties of substances;
>
> "(b) Development of new or improved methods of synthesis, analysis, separation or purification, or initial development of new or improved chemical processes or products;
>
> "(c) Application development; and
>
> "(d) Practice in the field of study."

5.6 CONCLUSION

Educational institutions generate waste streams that contain large varieties of chemicals, most in very small quantities. This puts educational institutions in a unique category, because they are required under RCRA to record and track each individual chemical once it becomes a waste. A number of schools simply do not comply with the regulations, either because they are unaware of them or because they assume that the regulations do not apply to them. The level of awareness varies widely among schools.

This chapter has identified possible ways to improve management of hazardous wastes from educational institutions. There is a need for an increased awareness of the regulations and their application. Unless school administrators and staff are made aware that they have a problem, it is impossible for them to institute changes that will overcome it. Dissemination of information by Federal and State agencies could increase the level of awareness and thus increase compliance with the regulations. EPA hopes that making this report publicly available will help to increase the awareness of schools about the hazardous waste regulations and appropriate hazardous waste management.

A number of options open to schools, both independently and collectively, have been discussed. However, ensuring proper waste management may be difficult for even the most diligent of schools. A higher level of awareness and commitment may be necessary to ensure proper waste management.

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*A copy of this reference is available for review in docket F-88-WEIA-FFFFF, located in the RCRA Docket, Room LG-100, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460. Docket hours are 9 a.m. to 4 p.m., Monday through Friday, excluding public holidays. To review docket materials, the public must make an appointment by calling (202) 475-9327.

**A copy of this reference is available for review in docket F-86-LDR-4-S0011, located in the RCRA Docket, at the above address.

APPENDICES

APPENDIX A

CASE STUDIES OF EDUCATIONAL INSTITUTIONS

CONTENTS

A.1 Introduction A-1
A.2 Criteria for Selection of Cases A-1
A.3 Colleges and Universities A-4
A.4 High Schools A-4

A.1 INTRODUCTION

Because detailed national studies do not exist in the literature, Tufts University, under contract to EPA, conducted case studies at selected schools throughout the country to obtain information about specific waste management programs. Tufts researchers gathered data from site visits, personal interviews, telephone interviews, correspondence, and privately circulated materials, such as in-house instructions for waste disposal. The Tufts University researchers visited 26 sites to obtain examples of all phases of hazardous waste management at high schools, colleges, and universities, and they conducted interviews with several individuals at each institution. They also collected in-house records and toured the sites involved in managing hazardous waste.

A.2 CRITERIA FOR SELECTION OF CASES

The Tufts University researchers visited high schools, colleges, and universities in Massachusetts, Rhode Island, Vermont, Minnesota, Oregon, California, and North Carolina. States that had lower small-quantity-generator limits than those set by EPA (discussed in Chapter 2) were included. Urban and rural sites, 2-year and 4-year postsecondary college programs, and schools likely to cooperate, schools with special features in their education programs, or schools with a good grasp of hazardous waste management issues were included. Other characteristics thought to affect hazardous waste management included size (measured by enrollment), public or private status, and curriculum (especially that portion related to science). The Tufts University researchers selected a representative sample of colleges and universities covering the various types of these institutions, based on directory and catalog data for colleges and universities that described the institutions by type, enrollment, and research funds. The final selection of high schools was made from those located close to the selected colleges and included vocational schools. The case-study schools (19 colleges and universities and 7 high schools) are described in Tables A-1 and A-2; none are identified, because a number of these schools required assurance of confidentiality as a condition of participation.

The Tufts University researchers assessed the colleges and universities and determined the generator category of each school studied: conditionally

Table A-1

College and University Case Studies

Group	Enrollment	Type[a]	Research and Development Funding (Millions of Dollars)[b]
A	1,100[c]	Public	–
	1,200	Private	–
	1,900	Private	–
	2,500[c]	Public	–
	3,600	Private	–
	4,900	Private	–
	11,400	Public	–
	11,400	Public	–
B	2,300	Private	–
	4,500	Public	–
	5,200	Public	–
C	6,900	Private	26
	7,400	Private	25
	9,500	Private	222
	12,000	Private	175[d]
	16,100	Private	123
	22,400	Public	65[e]
	29,300	Public	134
	43,100	Public	8

[a] J. Cass and M. Birnbaum, *Comparative Guide to American Colleges*, New York, Harper and Row, 1983.

[b] *Research Support Data Disks*, Washington, D.C., National Science Foundation, 1984 (Table B-30); *Federal Support to Universities, Colleges and Selected Non-Profit Institutions*, Washington, D.C., National Science Foundation, August 1985 (Table B-34).

[c] Number furnished by respondent.

[d] Estimate.

[e] Reported significant changes in fiscal year 1984 compared with fiscal year 1983, due to reclassifying of science and engineering awards and restructuring of some departments.

Table A-2

High School Case Studies

Code	Enrollment	Type	Nature	Location
A	1,000	Public	Vocational-technical	Suburban
B	1,300	Public	Comprehensive	Suburban
C	1,500	Public	Comprehensive	Suburban
D	1,600	Public	Comprehensive-vocational	Suburban
E	1,600	Public	Comprehensive	Urban
F	1,800	Public	Comprehensive-vocational	Urban
G	2,300	Public	Comprehensive	Urban

exempt small quantity generator (group A), small quantity generator (group B), or large quantity generator (group C). The researchers discovered that groups A and B had no substantial research and development funding.

A.3 COLLEGES AND UNIVERSITIES

The Tufts University researchers selected 19 colleges and universities from across the country as case studies for this report. Of these 19 institutions, 10 were public and 9 were private schools, with enrollment ranging from 1,000 to 43,000 students. Nine of the schools received substantial amounts of research and development funding ($1.2 to $175 million in 1984), and six of them were in the National Science Foundation's 1983 listing of the "top 100" recipients of industrial and Federal research and development funds. The researchers found that comparing the amounts of research funds received indicated relative potential for generation of hazardous waste.

A.4 HIGH SCHOOLS

Seven public high schools were studied, ranging in size from 1,000 to 2,300 students. There were four comprehensive high schools, two combined comprehensive-vocational schools, and one vocational-technical school. Four schools were in suburban areas and three were in urban areas.

APPENDIX B

REGULATIONS APPLICABLE TO TREATMENT, STORAGE, AND DISPOSAL FACILITIES

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B.1 Closure and Post-Closure B-1
B.2 Financial Requirements B-1
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  B.3.2 Tank Systems B-2
  B.3.3 Incinerators B-2
B.4 Other Requirements B-3

This appendix presents regulations under 40 CFR Parts 264 and 265 specific to particular waste management processes and closure, post-closure, and financial responsibility requirements that apply to educational institutions that must, for whatever reason, obtain EPA permits for treatment, storage, or disposal. As stated in Section 2.2.3, permitted treatment, storage, or disposal facilities must comply with all the requirements of Part 264, and interim status facilities must comply with requirements of Part 265. Because all of the provisions discussed below are similar for permitted and interim-status facilities, references for these provisions will be given for Part 264 only. These regulations are not applicable to conditionally exempt small quantity generators. Part 266 addresses recycling. Regulations under 40 CFR Part 268, which concern the requirements for the restriction from land disposal of hazardous waste, are discussed in Chapters 2 and 4 of this report. Facilities seeking EPA permits should not rely on the summary provided here, but rather should examine the regulations cited.

B.1 CLOSURE AND POST-CLOSURE

Closure care regulations apply to all owners and operators of treatment, storage, or disposal facilities; post-closure care regulations apply to disposal facilities, waste piles and surface impoundments from which the hazardous wastes will be removed at closure, and tank systems required to meet the landfill regulations (Subpart G, §§264.110-.120). The owner or operator must have a written closure plan and must close the facility in a way that minimizes the need for further maintenance and that controls, minimizes, or eliminates post-closure escape of hazardous wastes. The owner or operator must begin post-closure care activities upon completion of closure and must continue post-closure care for 30 years (unless the period is modified) in accordance with the approved post-closure plan.

B.2 FINANCIAL REQUIREMENTS

Owners and operators of treatment, storage, or disposal facilities, unless exempt, must comply with financial requirements (Subpart H, §§264.140-.151). Each owner or operator must have a written, detailed estimate of the cost of closing the facility and maintaining it after closure, in accordance with the applicable requirements of Part 264. Each owner or operator must establish financial assurance for facility closure and post-closure. Each owner or operator must obtain and maintain liability coverage for sudden accidental occurrences; in addition, the owner or operator of a surface impoundment, landfill, or land treatment facility must obtain and maintain liability coverage for nonsudden accidental occurrences.

B.3 WASTE MANAGEMENT PROCESSES

The regulations discussed in this section are specific to particular waste management processes and would apply to schools only if they used such processes.

B.3.1 Containers

Regulations regarding the use and management of containers (Subpart I, §§264.170-.178) apply to all treatment, storage, and disposal facilities that store containers of hazardous waste, unless they are exempted by §264.1. The owner or operator must use containers that are in good condition, do not leak, and are made of or lined with materials that will not react with and are otherwise compatible with the wastes to be stored. The owner or operator must inspect areas where containers are stored for possible leaks and deterioration, use a containment system in accordance with §264.175, and take precautions to avoid mixing incompatible wastes. The owner or operator must establish a buffer zone of at least 50 feet from the property line for containers of ignitable or reactive wastes (§264.176).

B.3.2 Tank Systems

Regulations covering tank systems (Subpart J, §§265.190-200) apply to treatment, storage, and disposal facilities that use tank systems to store or treat hazardous wastes, unless they are exempted by §264.1. In addition, §264.193 exempts tanks storing or treating hazardous waste that contain no free liquids and that are in a building with an impermeable floor, as well as tanks that serve as part of a secondary containment system to collect or contain releases of hazardous wastes. To prevent the release of hazardous waste to the environment, the owner or operator must provide a secondary containment and detection system in accordance with the technical standards specified in §264.193, and if a leak or spill occurs, the owner or operator must comply with the requirements of §264.196. The owner or operator also must develop and follow a schedule and procedures for inspecting the tank system. At closure, the owner or operator must remove or decontaminate all wastes or waste residues or contaminated system components and manage them as hazardous wastes, or close the tank system and perform post-closure care. Hazardous waste tank owners should examine State regulations for applicable provisions.

B.3.3 Incinerators

Incinerator regulations (Subpart O, §§264.340-.351) apply to treatment, storage, and disposal facilities (unless they are exempted by §264.1) that incinerate hazardous wastes or that burn hazardous wastes in boilers or in industrial furnaces to destroy them or for recycling purposes and that elect to be regulated under Subpart O. Certain wastes (identified in §264.340) are exempt from all incineration requirements except waste analysis and closure requirements. An incinerator of hazardous wastes must be designed, constructed, and maintained to meet the performance standards specified in §264.343 and must be operated in accordance with operating requirements specified in the permit. The owner or operator must conduct, at a minimum, monitoring and inspection of the incinerators in accordance with the requirements specified in §264.347. At closure, the owner or operator must remove all hazardous waste and hazardous waste residue. When hazardous waste is removed, at closure or during the operating life, the owner or operator becomes a generator and must manage the waste in accordance with the generator requirements under Part 262.

B.4 OTHER REQUIREMENTS

Those individuals who burn hazardous waste fuel for energy recovery are subject to requirements under Subpart D of Part 266. Those who burn used oil for energy recovery are subject to requirements under Subpart E of Part 266. Hazardous wastes containing precious metals are subject to requirements under Subpart F of Part 266; photoprocessing is an activity that may generate such wastes.

APPENDIX C

WASTE IDENTIFICATION AND MINIMIZATION

CONTENTS

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  C.1.2 Using This Appendix C-2
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C.1 INTRODUCTION

This appendix was prepared to serve as a reference guide for educational institutions and to provide them with information they will need to accomplish the following:

- Obtain an EPA identification number,
- Complete the Uniform Hazardous Waste Manifest for shipping their hazardous wastes off-site, and
- Begin planning how to minimize hazardous waste generation.

Appendix D contains addresses and phone numbers of EPA hotlines and agencies that administer hazardous waste regulations and that can provide more information on specific aspects of the regulations.

This appendix is divided into three sections. Section C.1 provides an introduction to the information excerpted from the guide. Section C.2 contains information specific to educational institutions, which will help them to identify the hazardous wastes that they generate and identify opportunities for minimizing hazardous waste. Tables C-1 and C-3 list the typical operations and processes used within educational institutions, the materials used, and the types of hazardous waste generated. Table C-1 examines the activities by laboratories, and Table C-3 examines the activities by vocational shops. Tables C-2 and C-4 list techniques that can be used to minimize or manage the kinds of waste generated. Table C-2 outlines techniques for laboratories, and Table C-4 outlines techniques for vocational shops. The reference list at the end of Section C.2 contains publications that provide additional technical information on minimizing waste.

Section C.3 contains a chart (Table C-5) listing the hazardous wastes discussed in Section C.2 and their proper Department of Transportation (DOT) shipping descriptions and corresponding EPA hazardous waste numbers. The information presented in Section C.3 is broadly applicable to both large and small quantity generators of hazardous waste. The information in Section C.3

that is summarized from the EPA regulations (40 CFR Part 261) and the DOT regulations (49 CFR Part 172) is not comprehensive; the regulations and the relevant agencies are the best sources for comprehensive and current information (see Appendix D). Whether a generator of hazardous waste uses this appendix or the regulations, the generator should describe the hazardous waste generated as precisely and completely as possible.

C.1.1 How This Appendix Can Help Educational Institutions

C.1.1.1 Obtaining an EPA Identification Number

If an institution generates more than about 220 pounds (one-half of a 55-gallon drum) of hazardous waste in any calendar month it must obtain an EPA identification number. To apply for an identification number, the institution must complete EPA Form 8700-12, "Notification of Hazardous Waste Activity," which can be obtained from the State hazardous waste management agency or the EPA regional office. Item X of the form requires identification of hazardous waste by its EPA hazardous waste number. Section C.3 contains EPA hazardous waste numbers for wastes commonly generated by educational institutions.

C.1.1.2 Completing the Uniform Hazardous Waste Manifest

If an institution generates more than about 220 pounds (one-half of a 55-gallon drum) of hazardous waste in any calendar month and it ships the waste off-site for treatment, storage, or disposal, it must complete a Uniform Hazardous Waste Manifest. The manifest must accompany any hazardous wastes shipped off-site. Item 11 of the manifest requires the proper DOT shipping description for the wastes being transported. Section C.3 provides the proper DOT shipping descriptions for a number of hazardous wastes commonly generated by educational institutions.

C.1.1.3 Minimizing the Hazardous Waste Generated

Suggestions for minimizing hazardous waste generation have been included in the waste minimization tables (Tables C-2 and C-4) in this appendix. The letters "WM" in Tables C-1 and C-3 indicate that waste minimization information for the specific process or waste so designated can be found in Tables C-2 and C-4, which also contain more general information on waste minimization and management. These suggestions may help educational institutions to reduce the amounts of hazardous waste that they generate and thus reduce the costs and liabilities that they face in managing these wastes. The information contained in this appendix is not exhaustive; it is intended to indicate the variety of cost-effective opportunities that are available. See the references listed at the end of Section C.2 for additional information.

C.1.2 Using This Appendix

Tables C-1 and C-3 list processes and materials and the major hazardous waste categories associated with them. An educational institution can identify activities that may generate hazardous wastes and proceed to Section C.3 for more EPA and DOT information.

C.1.2.1 EPA and Department of Transportation (DOT) Information

In Table C-4 (Section C.3), wastes are entered in alphabetical order under each category. The entries opposite the wastes provide DOT shipping descriptions for the manifest and, in the extreme right column, the EPA hazardous waste numbers for the notification form.

As indicated throughout Section C.2, many industries generate hazardous wastes that are either listed, characteristic, or acute hazardous. Listed hazardous wastes are wastes that EPA has identified by name in the regulations. These wastes have EPA hazardous waste numbers that begin with the letters "F," "K," "P," and "U." Characteristic hazardous wastes are either ignitable, corrosive, reactive, or extraction procedure (EP) toxic. See 40 CFR Part 261 for the regulations that define hazardous waste.

Ignitable Wastes: Ignitable wastes are liquids with flashpoints of less than 140 $^{\circ}$F (60 $^{\circ}$C), solids that ignite spontaneously through absorption of moisture or through friction and that burn vigorously, and ignitable compressed gases or oxidizers as defined by DOT.

Corrosive Wastes: Corrosive wastes include aqueous solutions with pH values less than or equal to 2 or greater than or equal to 12.5 and liquids that corrode steel at rates of more than 0.25 inch per year.

Reactive Wastes: Reactive wastes include substances that are unstable and readily undergo violent change; react violently with water; form potentially explosive mixtures with water; are capable of detonation or explosive reactions when exposed to strong initiating sources; generate significant quantities of toxic gases when exposed to water or, in the case of cyanide or sulfide-bearing wastes, have pH values between 2 and 12.5; are a capable of detonation or explosive reactions at standard temperature and pressure; or are forbidden, class A, or class B explosives as defined by DOT.

EP Toxic Wastes: Wastes are EP toxic if extracts from the wastes contain more than the concentrations of arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, endrin, lindane, methoxychlor, toxaphene, 2,4-D, or 2,4,5-TP specified in the Resource Conservation and Recovery Act (RCRA) regulations at 40 CFR 261.24.

Acute and Listed Hazardous Wastes: Acute hazardous wastes are also listed hazardous wastes and are identified by EPA in the hazardous waste regulations by EPA hazardous waste numbers between F020 and F027 or by numbers that begin with the letter "P."

C.1.2.2 Waste Minimization

Tables C-2 and C-4 provide waste minimization suggestions corresponding to the processes and wastes identified by "WM" in Tables C-1 and C-3, as well as general information on waste minimization and management. The number and variety of books and reports concerned with waste minimization is large and is rapidly growing. For additional information, and more detailed technical descriptions of feasible waste reduction options, see the reference list at the end of Section C.2.

C.2 INFORMATION SPECIFIC TO EDUCATIONAL INSTITUTIONS

C.2.1 Overview

Educational institutions may include teaching and research laboratories and may include vocational shops engaged in automotive and small engine repair, automobile body repair, metalworking graphic arts production (for example, printing or photography), and woodworking.

If an educational institution generates more than 220 pounds (about half of a 55-gallon drum) of hazardous waste per month, it must obtain an EPA identification number and, if it ships the waste off its property, fill out a Uniform Hazardous Waste Manifest. Some States require the manifesting of less than 220 pounds of hazardous waste, so each institution should check with its State hazardous waste management agency to determine requirements under State law.

Although not all educational institutions produce each of the wastes listed, it is likely that every institution produces some of them. If a school is unable to find a particular chemical that it uses or a waste that it generates in Table C-1 or C-3, it should contact it State hazardous waste management agency or EPA regional office (see Appendix D for addresses and phone numbers) or refer to EPA's *Understanding the Small Quantity Generator Rules: A Handbook for Small Business.*

C.2.2 Hazardous Wastes from Laboratories

Laboratories generate too great a variety of wastes to identify in this appendix. The following discussion identifies the general sources of laboratory waste and provides examples of specific wastes generated by laboratories.

The following wastes are commonly generated by laboratories:

- Spent solvents, used in cleaning, extraction, and other processes
- Unused reagents that are no longer needed, do not meet specifications, have become contaminated, have exceeded their storage lives, or are otherwise unusable in laboratories
- Reaction products, either of known or of unknown composition (to facilitate disposal, laboratories should try to identify or characterize reaction products to the extent possible and label them)
- Test samples that are not entirely consumed by the test procedure
- Contaminated materials, such as glassware, paper, and plastic products

Spent solvents and unused reagents generally constitute the majority of laboratory wastes. Laboratories in general produce a variety of hazardous wastes that are often ignitable, corrosive, reactive, EP toxic, or acutely hazardous.

Radioactive wastes, which some laboratories generate, are generally regulated under the Atomic Energy Act and therefore are excluded from EPA regulation under RCRA. EPA is presently developing regulations for the management of low-level radioactive wastes under the Toxic Substances Control Act. Nuclear Regulatory Commission and DOT regulations, however, may apply; generators of radioactive wastes should contact the Nuclear Regulatory Commission, the DOT Materials Transport Bureau, or the State transportation agency for more information concerning proper transport and disposal of these wastes.

Mixed wastes are wastes that are radioactive and either exhibit hazardous characteristics or are listed as hazardous wastes. Mixed wastes are subject to regulation under the Atomic Energy Act and under RCRA. Generators or handlers of these wastes should contact the appropriate EPA Regional Office.

Table C-1 lists typical laboratory processes and operations that use products that may contain hazardous materials and that probably generate hazardous wastes. Table C-2 provides recommendations to help minimize hazardous waste generation by laboratories.

C.2.2 Hazardous Wastes from Vocational Shops

[illegible]

[illegible]

[illegible]

C.2.3 [illegible]

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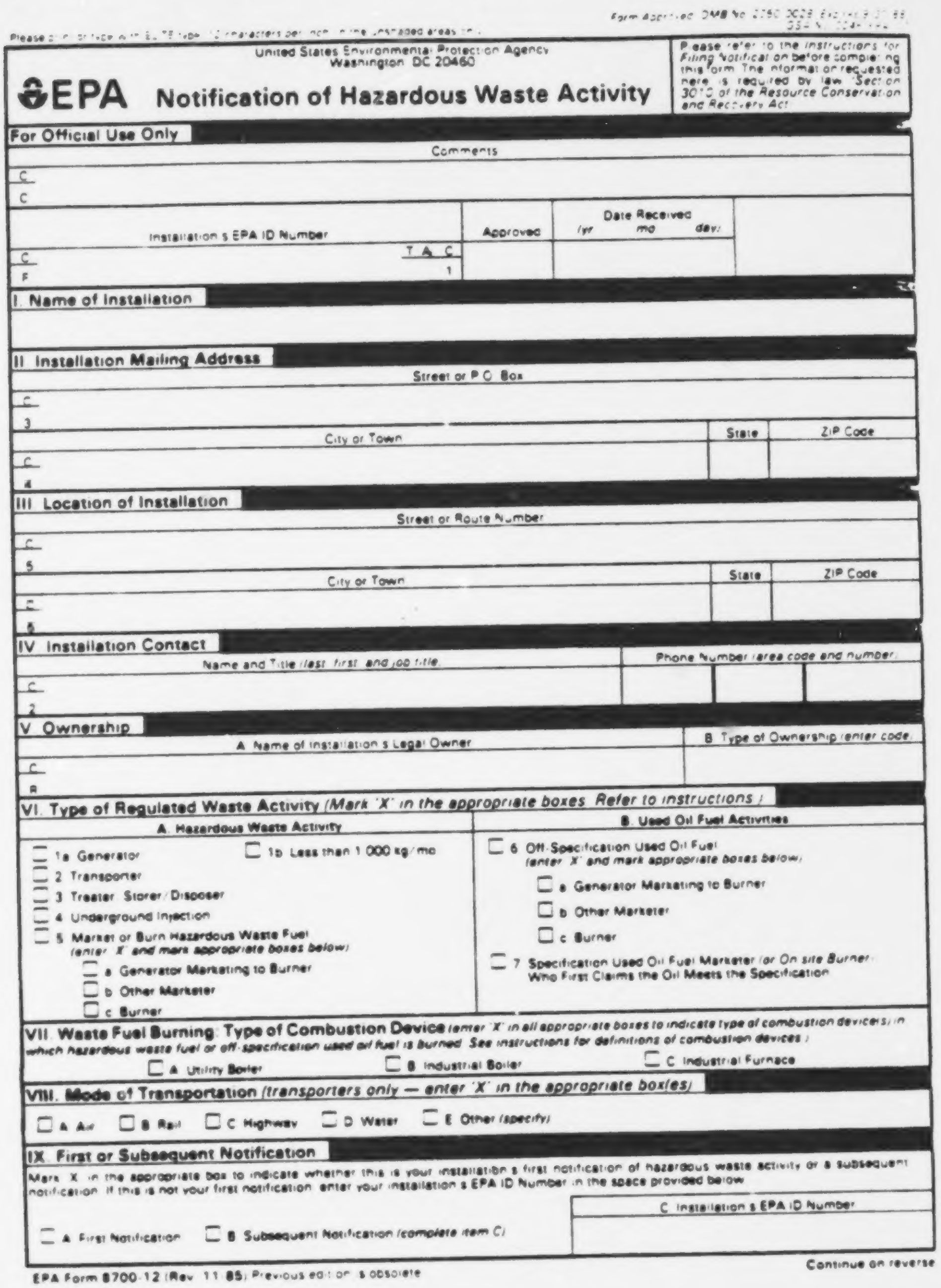
C.3 [illegible] OF SPECIFIC HAZARDOUS WASTES

Table C-2 contains EPA- and DOT-specific information for a number of commonly generated hazardous wastes. Obtaining an EPA identification number requires completing the "Notification of Hazardous Waste Activity" form. This form requires inserting the appropriate EPA hazardous waste number in item X. Exhibit C-1 is a sample form.

The DOT waste description is necessary to complete the Uniform Hazardous Waste Manifest. The DOT description includes the proper shipping name, the hazard class, and the applicable UN/NA identification number. As required, any additional information must appear either before or after the DOT description, as appropriate. Table C-2 contains this information for many commonly generated hazardous wastes. This information must be written in item 11 of the Uniform Hazardous Waste Manifest. Exhibit C-2 is a sample manifest.

Exhibit C-1

Sample Notification of Hazardous Waste Activity Form (EPA Form 8700-12)



Form Approved OMB No 2050 0028 Expires 9 30 88
GSA No [illegible]

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

United States Environmental Protection Agency
Washington DC 20460

EPA Notification of Hazardous Waste Activity

Please refer to the Instructions for Filing Notification before completing this form. The information requested here is required by law (Section 3010 of the Resource Conservation and Recovery Act).

For Official Use Only

Comments

C

C

Installation s EPA ID Number	Approved	Date Received (yr mo day)
C T A C F 1		

I. Name of Installation

II. Installation Mailing Address

Street or P O Box

C 3

City or Town	State	ZIP Code
C 4		

III. Location of Installation

Street or Route Number

C 5

City or Town	State	ZIP Code
C 6		

IV. Installation Contact

Name and Title (last first and job title)	Phone Number (area code and number)
C 2	

V. Ownership

A Name of Installation s Legal Owner	B Type of Ownership (enter code)
C 8	

VI. Type of Regulated Waste Activity *(Mark 'X' in the appropriate boxes. Refer to instructions.)*

A. Hazardous Waste Activity

- ☐ 1a Generator ☐ 1b Less than 1 000 kg/mo
- ☐ 2 Transporter
- ☐ 3 Treater Storer/Disposer
- ☐ 4 Underground Injection
- ☐ 5 Market or Burn Hazardous Waste Fuel *(enter 'X' and mark appropriate boxes below)*
  - ☐ a Generator Marketing to Burner
  - ☐ b Other Marketer
  - ☐ c Burner

B. Used Oil Fuel Activities

- ☐ 6 Off-Specification Used Oil Fuel *(enter 'X' and mark appropriate boxes below)*
  - ☐ a Generator Marketing to Burner
  - ☐ b Other Marketer
  - ☐ c Burner
- ☐ 7 Specification Used Oil Fuel Marketer *(or On site Burner)* Who First Claims the Oil Meets the Specification

VII. Waste Fuel Burning: Type of Combustion Device *(enter 'X' in all appropriate boxes to indicate type of combustion device(s) in which hazardous waste fuel or off-specification used oil fuel is burned. See instructions for definitions of combustion devices.)*

☐ A Utility Boiler ☐ B Industrial Boiler ☐ C Industrial Furnace

VIII. Mode of Transportation *(transporters only — enter 'X' in the appropriate box(es))*

☐ A Air ☐ B Rail ☐ C Highway ☐ D Water ☐ E Other *(specify)*

IX. First or Subsequent Notification

Mark 'X' in the appropriate box to indicate whether this is your installation s first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your installation s EPA ID Number in the space provided below.

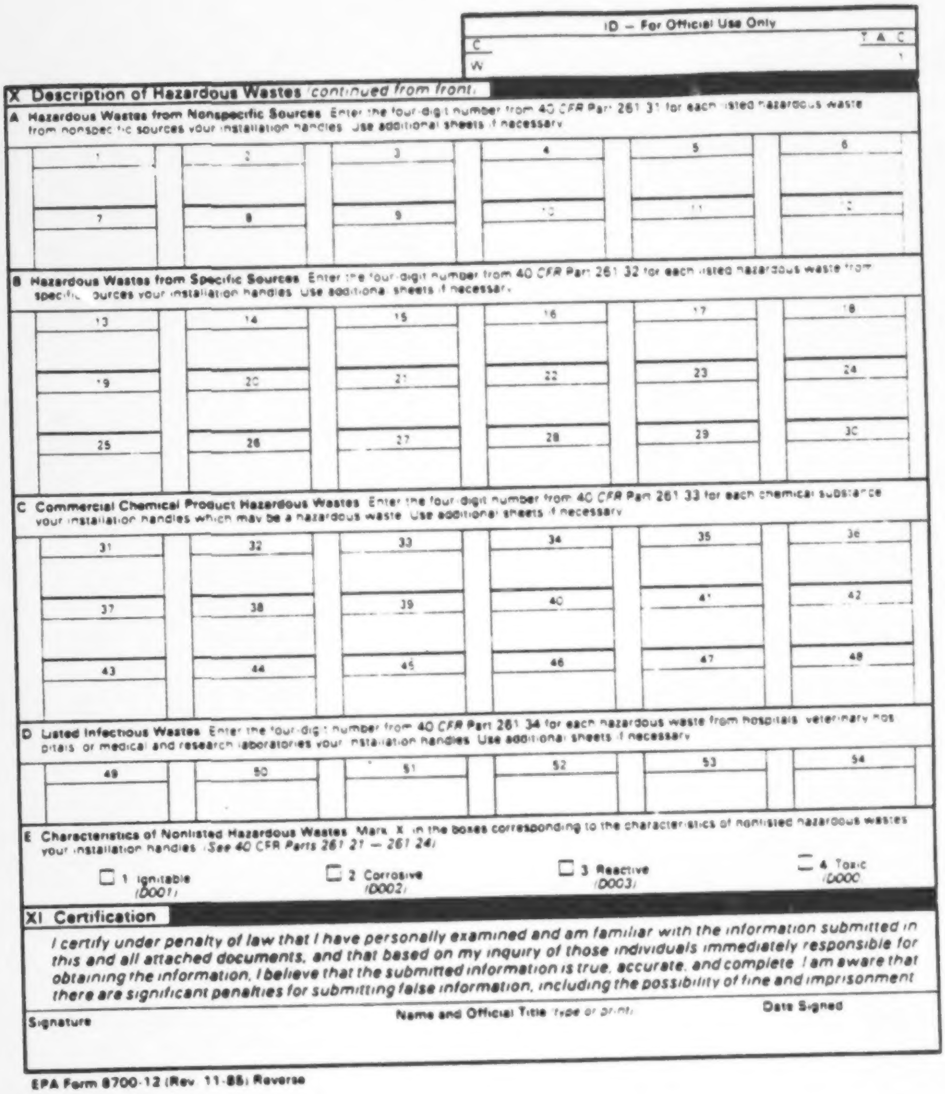
☐ A First Notification ☐ B Subsequent Notification *(complete item C)*

C Installation s EPA ID Number

EPA Form 8700-12 (Rev 11 85) Previous edition is obsolete

Continue on reverse

Exhibit C-1 (Continued)



ID — For Official Use Only		
C		T A C
W		1

X Description of Hazardous Wastes *(continued from front)*

A Hazardous Wastes from Nonspecific Sources Enter the four-digit number from 40 *CFR* Part 261.31 for each listed hazardous waste from nonspecific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B Hazardous Wastes from Specific Sources Enter the four-digit number from 40 *CFR* Part 261.32 for each listed hazardous waste from specific sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C Commercial Chemical Product Hazardous Wastes Enter the four-digit number from 40 *CFR* Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D Listed Infectious Wastes Enter the four-digit number from 40 *CFR* Part 261.34 for each hazardous waste from hospitals, veterinary hospitals, or medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E Characteristics of Nonlisted Hazardous Wastes Mark "X" in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 — 261.24)*

☐ 1. Ignitable *(D001)*   ☐ 2. Corrosive *(D002)*   ☐ 3. Reactive *(D003)*   ☐ 4. Toxic *(D000)*

XI Certification

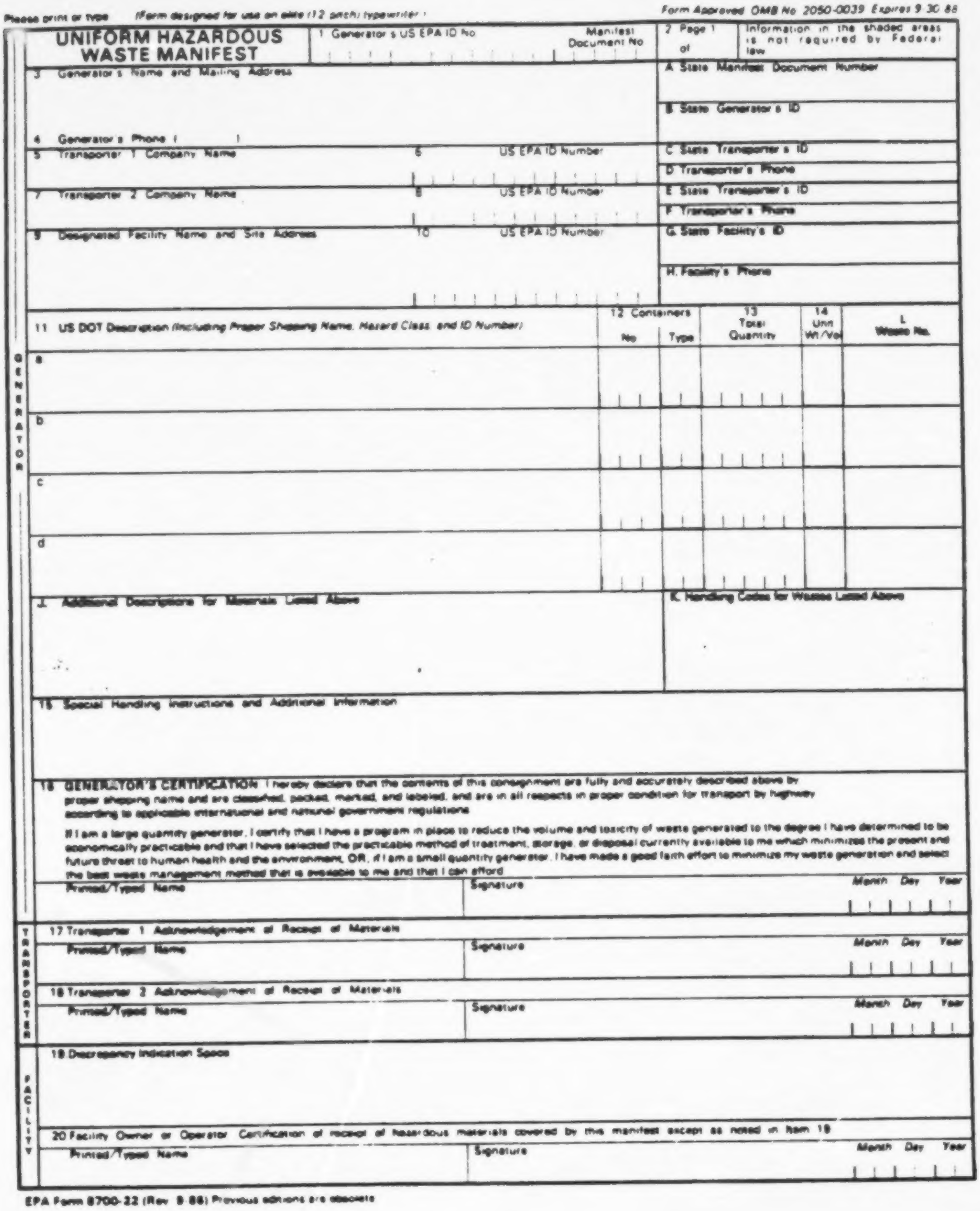
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature	**Name and Official Title** *(type or print)*	**Date Signed**

EPA Form 8700-12 (Rev. 11-85) Reverse

Exhibit C-2

Sample Uniform Hazardous Waste Manifest (EPA Form 8700-22)



Please print or type (Form designed for use on elite (12 pitch) typewriter.)

Form Approved OMB No 2050-0039 Expires 9 30 88

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No

Manifest Document No

2 Page 1 of

Information in the shaded areas is not required by Federal law

3 Generator's Name and Mailing Address

4 Generator's Phone ( )

A State Manifest Document Number

B State Generator's ID

5 Transporter 1 Company Name

6 US EPA ID Number

C State Transporter's ID

D Transporter's Phone

7 Transporter 2 Company Name

8 US EPA ID Number

E State Transporter's ID

F Transporter's Phone

9 Designated Facility Name and Site Address

10 US EPA ID Number

G State Facility's ID

H Facility's Phone

11 US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No	12 Containers Type	13 Total Quantity	14 Unit Wt/Vol	L Waste No.
a					
b					
c					
d					

J Additional Descriptions for Materials Listed Above

K Handling Codes for Wastes Listed Above

15 Special Handling Instructions and Additional Information

16 GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment, OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name | Signature | Month Day Year

17 Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

18 Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

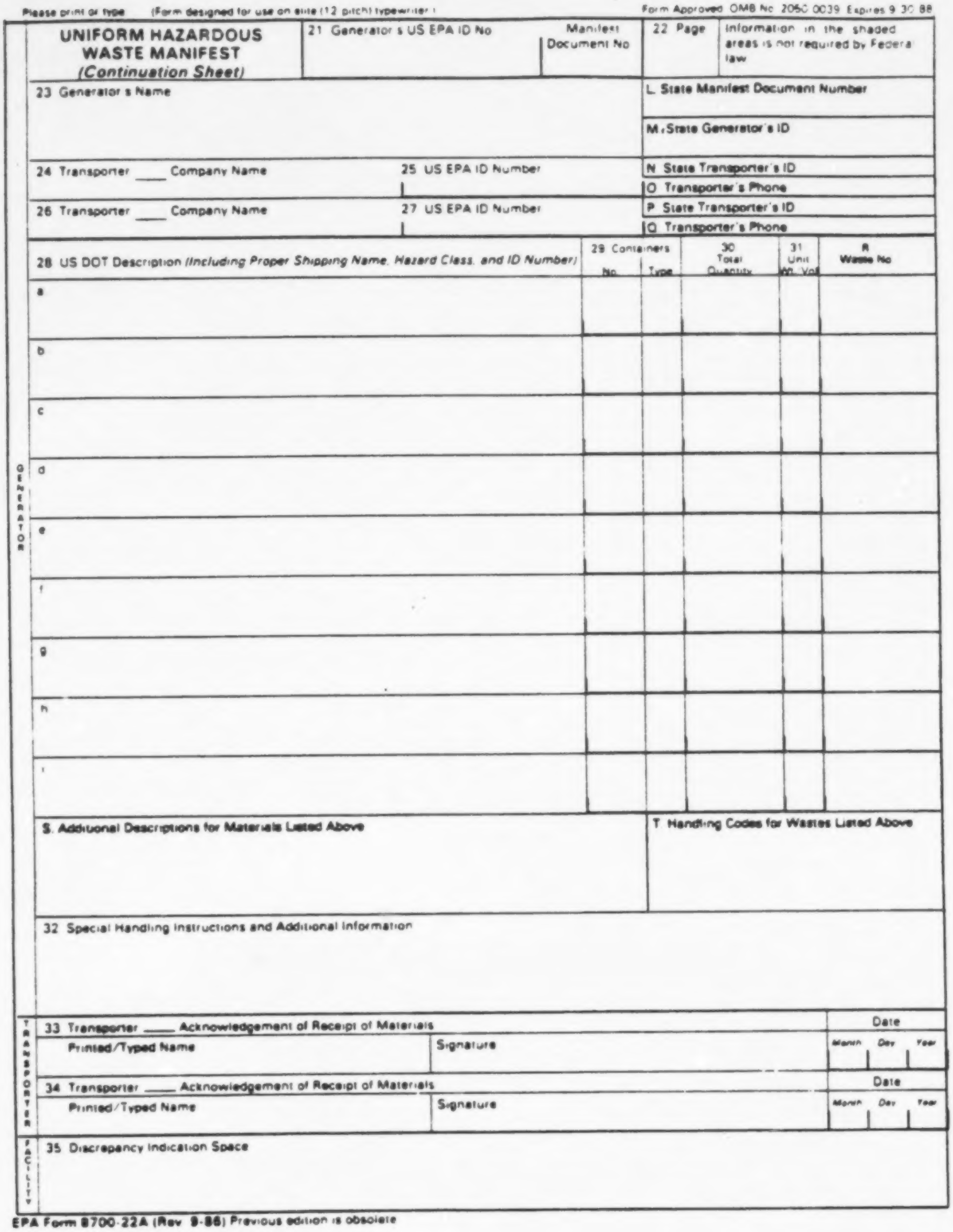
19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name | Signature | Month Day Year

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

Exhibit C-2 (Continued)



Please print or type (Form designed for use on elite (12 pitch) typewriter.) Form Approved OMB No 2050-0039 Expires 9-30-88

UNIFORM HAZARDOUS WASTE MANIFEST
(Continuation Sheet)

21 Generator's US EPA ID No

Manifest Document No

22 Page

Information in the shaded areas is not required by Federal law

GENERATOR

23 Generator's Name

L State Manifest Document Number

M State Generator's ID

24 Transporter ____ Company Name

25 US EPA ID Number

N State Transporter's ID

O Transporter's Phone

26 Transporter ____ Company Name

27 US EPA ID Number

P State Transporter's ID

Q Transporter's Phone

28 US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	29 Containers		30 Total Quantity	31 Unit Wt/Vol	**R Waste No**
	No	Type			
a					
b					
c					
d					
e					
f					
g					
h					
i					

S Additional Descriptions for Materials Listed Above

T Handling Codes for Wastes Listed Above

32 Special Handling Instructions and Additional Information

TRANSPORTER

33 Transporter ____ **Acknowledgement of Receipt of Materials**

		Date		
Printed/Typed Name	Signature	Month	Day	Year

34 Transporter ____ **Acknowledgement of Receipt of Materials**

		Date		
Printed/Typed Name	Signature	Month	Day	Year

FACILITY

35 Discrepancy Indication Space

EPA Form 8700-22A (Rev 9-86) Previous edition is obsolete

Table C-1

Typical Operations: Materials Used and Hazardous Wastes That May Be Generated by Laboratories

Typical Process or Operation	Typical Materials Used	Waste Minimization Opportunities	Major Hazardous Waste Categories[a]
Laboratories	Solvents, reagents, samples, disposable labware	WM[b]	Acid or alkaline wastes Solvent wastes

[a] Specific EPA and DOT information is contained in Table C-5.

[b] "WM" indicates that waste minimization information for the specific process or waste is in Table C-2, which also contains more general information on waste minimization and management.

Table C-2

Waste Minimization for Laboratories

Typical Process or Operation	Minimization and Management Opportunities
General Laboratory Management Techniques	• Purchase smaller quantities and smaller sized containers of chemicals. Chemicals often last longer when kept in unopened, air- and moisture-free containers. Often chemists will not use opened bottles of chemicals because of concern about purity. When large containers of chemicals are purchased, significant portions frequently remain unused and must be disposed. Purchase chemicals in sizes that are commensurate with use. When disposal costs of unused materials are added to the purchase price of a chemical, it is often uneconomical to buy large containers. • Maintain an inventory of all laboratory chemicals purchased, and keep track of the status and age of the chemicals within a laboratory. Keep stock rotating. Use older chemicals first. Do not purchase more chemicals than can be used within the shelf life of the material. Depending on the size and resources of the laboratory, this inventory system can be computerized or simply kept in a card file. Having an inventory of chemicals is a prerequisite for the exchange and reuse of chemicals within a particular institution, or for participation in a regional waste exchange. Duplicate purchases of chemicals can be reduced by distributing the list of chemicals within an institution. • Some institutions maintain centralized storage areas for unused chemicals. Often these chemicals are arranged on shelves in alphabetical order by name. This may cause incompatible chemicals to be stored close together. Chemicals should be stored according to chemical compatibility in storage areas that are well ventilated and monitored to ensure that labeling of materials is adequate and that deteriorated chemicals do not remain in storage. • Laboratories can distribute lists of unused chemicals within the institution or among a group of local institutions. Lists of wastes, if prepared in sufficient quantities, can be distributed to local and regional waste exchanges. • Chemical containers can often be returned to the manufacturer or distributor.

Table C-2 (Continued)

Typical Process or Operation	Minimization and Management Opportunities
Chemical Substitution	• Laboratories should evaluate the feasibility of using less hazardous materials in laboratory procedures. The following are examples of this type of substitution: – Replacements can be found for some cleaning agents. For example, laboratory detergents can sometimes be used in place of such materials as chromic acid solution and alcoholic potassium solution. – Substitutes often can be found for benzene and carbon tetrachloride. For example, in the standard qualitative test for halide ions, cyclohexane can be used instead of carbon tetrachloride. – Acetamide can be replaced, under specified conditions, by stearic acid in such laboratory procedures as phase changes and freezing point depressions.
Solvent Waste Management and Recovery and Reuse	• Solvent wastes should be labeled and segregated. Wastes should be segregated into at least the following categories: – Chlorinated solvents (for example, methylene chloride) – Aliphatic hydrocarbon and oxygenated hydrocarbon solvents (for example, mineral spirits, hexane) – Aromatic hydrocarbons (for example, benzene) If substantial quantities of any particular solvent are generated, they should be kept separate. • The use of solvents for cleaning glassware can be reduced by employing used solvent for the first cleaning, and fresh solvent for subsequent and final cleaning. This procedure decreases the amount of clean solvent required.

Table C-2 (Continued)

Typical Process or Operation	Minimization and Management Opportunities
	• Certain types of solvent wastes can be distilled in-house. Solvent stills are available in a variety of small sizes, including high-quality fractional distillation units. Solvents can be distilled for reuse within a particular laboratory or by other divisions in an organization. For example, teaching laboratories can use recyled solvents from academic departments for classroom experiments, which often can use solvents of lower purity. Distilled solvents also can be used as thinners and degreasers by maintenance divisions in an institution. Segregation of solvent wastes is extremely important in recycling and is a good tracking system to account for the waste. Still bottoms must be handled as hazardous waste.
Use of Chemicals for Fuel	• Certain flammable organic solvents can be used as fuel in existing boilers. These organic solvents include acetone, butyl alcohol, heptane, and hexane. *It should be noted, however, that the burning of waste chemicals in boilers may be restricted by local, State, or Federal regulations or by the permits of particular boilers.*
Recovery of Metals	• Small amounts of metallic mercury can be recovered by filtration, conducted in a hood. The filter paper, however, must be disposed of as a hazardous waste. • Electrolytic recovery techniques can be used to recover silver from photographic solutions. • Metals, such as platinum, palladium, and rhodium, contained in spent catalysts can be recovered by chemical procedures specific to the particular metals.
Microscale Experiments	• Conducting experiments on a smaller scale, using special glassware and other equipment, is an option that can reduce both the quantities of reagents used and the amount of waste generated.

Table C-3

Typical Operations: Materials Used and Hazardous Wastes That May Be Generated by Vocational Shops

Typical Process or Operation	Typical Materials Used	Typical Material Ingredients on Label	Waste Minimization Opportunities[a]	Major Hazardous Waste Categories[b]
		Automobile Engine and Body Repair, Metalworking		
Degreasing; Metal and Tool Cleaning; Engine Parts, and Equipment Equipment Cleaning	Solvents, varsol, carburetor cleaners, degreasers, cleaning fluids, acids, alkalies, engine cleaners	Petroleum distillates, aromatic hydrocarbons, mineral spirits, benzene, toluene, petroleum naphtha		Acid and alkaline wastes
			WM	Ignitable wastes—NOS[c]
			WM	Solvent wastes
Rust Removal	Naval jelly, strong acid or alkaline solutions	Phosphoric acid, hydrochloric acid, hydrofluoric acid, sodium hydroxide		Acid and alkaline wastes
Painting	Enamels, lacquers, epoxies, alkyds, acrylics, primers, solvents	Acetone, toluene, petroleum distillates, epoxy ester resins, methylene chloride, xylene, V.M.&P. naphtha, aromatic hydrocarbons, methyl isobutyl ketones	WM	Ignitable wastes—NOS
			WM	Paint wastes
			WM	Solvent wastes
Spray Booths, Spray Guns, Brush Cleaning; Paint Removal and Paint Preparation	Solvents, paint thinners, enamel reducers, white spirits	Acetone, toluene, petroleum distillates, methanol, methylene chloride, isopropanol, mineral spirits, alcohols, ketones, other oxygenated solvents		Paint wastes
				Solvent wastes

Table C-3 (Continued)

Typical Process or Operation	Typical Materials Used	Typical Material Ingredients on Label	Waste Minimization Opportunities[a]	Major Hazardous Waste Categories[b]
Used Lead-Acid Batteries (Excluding Those Sent for Recycling)	Car, truck, boat, motorcycle, and other vehicle batteries			Acid and alkaline wastes Batteries (lead-acid)
			Graphic Arts	
Plate Preparation:				
Counter-Etch To Remove Oxide	Phosphoric acid	Phosphoric acid		Acid and alkaline wastes
Deep-Etch Coating of Plates	Deep-etch bath	Ammonium dichromate, ammonium hydroxide		Acid and alkaline wastes Heavy metal wastes-solutions
Etch Baths	Etch baths for plates	Ferric chloride (copper), aluminum chloride/zinc chloride/hydrochloric acid (chromium); nitric acid (zinc, magnesium)		Acid and alkaline wastes Heavy metal wastes-solutions
Apply Light Sensitive Coating	Resins, binders, emulsion, photosensitizers, gelatin, photoinitiators	Polyvinyl alcohol/ammonium dichromate, polyvinyl cinnamate, fish glue/albumin, silver halide/gelatin emulsion, gum arabic/ammonium dichromate		Photographic processing wastes

Table C-3 (Continued)

Typical Process or Operation	Typical Materials Used	Typical Material Ingredients on Label	Waste Minimization Opportunities[a]	Major Hazardous Waste Categories[b]
Develop Plates	Developer	Lactic acid, zinc chloride, magnesium chloride		Photographic processing wastes
Wash and Clean Plates	Alcohols, solvents	Ethyl alcohol, isopropyl alcohol, methyl ethyl ketone, trichloroethylene, perchloroethylene		Solvent wastes
Apply Lacquer	Resins, solvents, vinyl lacquer	Polyvinyl chloride, polyvinyl alcohol maleic acid, methyl ethyl ketone		Solvent wastes
Ink	Pigments, dyes, varnish, drier, extender, modifier	Titanium oxide, iron' blues, molybdated chrome orange, phthalocyanide pigments, oils, hydrocarbon solvents, waxes, cobalt/zinc manganese oleates, plasticizers		Ink-sludges with chromium or lead Ink-waste
Making Gravure Cylinders	Acid plating bath	Copper, hydrochloric acid		Plating wastes
Painting	Solvents, paint with solvents, heavy metals	Ethylene dichloride, benzene, toluene, ethylbenzene, chlorobenzene, methyl ethyl ketone	WM WM	Ignitable wastes-NOS Paint wastes

Table C-3 (Continued)

Typical Process or Operation	Typical Materials Used	Typical Material Ingredients on Label	Waste Minimization Opportunities[a]	Major Hazardous Waste Categories[b]
		Woodworking		
Wood Cleaning and Wax Removal	Petroleum distillates, white spirits	Petroleum distillates, mineral spirits		Ignitable wastes-NOS Solvent wastes
Refinishing and Stripping; Brush Cleaning and Spray Gun Cleaning	Paint removers, varnish removers, enamel removers, shellac removers, paint solvents, turpentine	Acetone, toluene, petroleum distillates, mineral spirits, methanol, methylene chloride, alcohols, ketone, oxygenated solvents		Ignitable wastes-NOS Paint wastes Solvent wastes
Staining	Stains	Mineral spirits, alcohols, pigments		Ignitable wastes-NOS Solvent wastes
Painting	Enamels, lacquers, epoxy, alkyds, acrylics, primers, solvents	Toluene, pigments, titanium dioxide, epoxy-ester resins, aromatic hydrocarbons, glycol ether, halogenated hydrocarbons, vinyl acetate acrylic	WM WM WM	Ignitable wastes-NOS Paint wastes Solvent wastes

Table C-3 (Continued)

Typical Process or Operation	Typical Materials Used	Typical Material Ingredients on Label	Waste Minimization Opportunities[a]	Major Hazardous Waste Categories[b]
Finishing	Varnish, shellac, polyurethane, lacquers	Denatured alcohols, resins, shellac, petroleum distillates, toluene diisocyanate		Ignitable wastes-NOS Solvent wastes

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[a] "WM" indicates that wastes minimization information for the specific process or waste can be found in Table C-4, which also contains more general information on waste minimization and management.

[b] Specific EPA and DOT information is contained in Table C-5.

[c] NOS, Not otherwise specified.

Table C-4

Waste Minimization for Vocational Shops

Typical Process or Operation	Major Hazardous Waste Categories	Minimization and Management Opportunities
Metal Cutting	Waste cutting oils	• In some metal-cutting operations, oils can be recycled, without any treatment, until they are consumed. • It is generally beneficial to standardize oils and, if possible, to use one type of oil for many kinds of machining.
Degreasing	Solvent wastes; ignitable wastes-NOS[a]	• Using less hazardous solvent degreasers reduces the hazards and toxicity of the degreasing process. Biodegradable water-based cleaners presently marketed may also be used for degreasing. • Covering the vapor degreasing unit reduces loss of solvent to the atmosphere. Rotating parts before removal from the vapor degreaser allows condensed solvent to return to the degreasing unit. • Only degrease parts that must be cleaned. Do not routinely degrease all parts. • Spent degreasing solvents can be recycled on site using small batch stills. Contractual agreements can be entered into with companies that supply fresh solvents and remove and recover the usable fraction of spent solvents.
Painting	Ignitable wastes-NOS; paint wastes; solvent wastes	• Certain spray-painting techniques can reduce the amount of paint required for a job and can also reduce paint wastes. The techniques include setting correct air pressure for the gun and the use of certain stroking techniques, such as overlapping the spray pattern by 50 percent, maintaining a distance of 6-8 inches from the work piece, holding the gun perpendicular to the surface, and triggering the gun at the beginning and end of each stroke.

Table C-4 (Continued)

Typical Process or Operation	Major Hazardous Waste Categories	Minimization and Management Opportunities
Spray Booth, Spray Guns, and Brush Cleaning	Solvent wastes; paint wastes	• To conserve solvent in cleaning operations, dirty solvent should be used first. Fresh solvent should only be used for final cleaning.

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[a] NOS, Not otherwise specified.

Table C-5

Categories of Specific Hazardous Wastes, Including EPA and DOT Information

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
	Acid and Alkaline Wastes				
Acetic Acid	Waste Acetic Acid (Aqueous Solution)	Corrosive Material	UN2790	(EPA-Corrosive), RQ	D002
Ammonium Hydroxide NH_4OH, Spirit of Hartshorn, Aqua Ammonia	Waste Ammonium Hydroxide (containing not less than 12% but not more than 44% ammonia)	Corrosive Material	NA2672	(EPA-Corrosive), RQ	D002
	Waste Ammonium Hydroxide (containing less than 12% ammonia)	ORM-A	NA2672	(EPA-Corrosive), RQ	D002
Chromic Acid	Waste Chromic Acid Solution	Corrosive Material	UN1755	(EPA-EP Toxic[c]), RQ	D007
Hydrobromic Acid HBr	Waste Hydrobromic Acid (more than 49% strength)	Corrosive Material	UN1788	(EPA-Corrosive), RQ	D002
Hydrochloric Acid HCl, Muriatic Acid	Waste Hydrochloric Acid	Corrosive Material	UN1789	(EPA-Corrosive), RQ	D002
Hydrofluoric Acid HF, Fluorohydric Acid	Waste Hydrofluoric Acid Solution	Corrosive Material	UN1790	(EPA-Corrosive), RQ	D002
Lacquer, Paint, or Varnish Removing Liquid	Waste Paint Related Material	Corrosive Material	NA1760	(EPA-Corrosive), RQ	D002
	Waste Paint Related Material	Combustible Liquid	NA1263	(EPA-Ignitable), RQ	D001
	Waste Paint Related Material	Flammable Liquid	NA1263	(EPA-Ignitable), RQ	D001
Nitrates	Waste Nitrate, NOS[d]	Oxidizer	NA1477	(EPA-Ignitable), RQ	D001
Nitric Acid HNO_3, Aquafortis	Waste Nitric Acid (over 40%)	Oxidizer	UN2031	(EPA-Ignitable), RQ	D001
	Waste Nitric Acid (40% or less)	Corrosive Material	NA1760	(EPA-Corrosive), RQ	D002

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Oleum Fuming Sulfuric Acid	Waste Oleum	Corrosive Material	NA1831	(EPA-Corrosive), RQ	D002
Perchloric Acid	Waste Perchloric Acid (50%-72%) Waste Perchloric Acid (not over 50%)	Oxidizer Oxidizer	UN1873 UN1802	(EPA-Ignitable), RQ (EPA-Ignitable), RQ	D001 D001
Phosphoric Acid H_3PO_4, o-phosphoric acid	Waste Phosphoric Acid	Corrosive Material	UN1805	(EPA-Corrosive), RQ	D002
Potassium Hydroxide KOH, Potassium Hydrate, Caustic Potash, Potassa	Waste Potassium Hydroxide Solution	Corrosive Material	UN1814	(EPA-Corrosive), RQ	D002
Sodium Hydroxide NaOH, Caustic Soda, Soda Lye, Sodium Hydrate	Waste Sodium Hydroxide Solution	Corrosive Material	UN1824	(EPA-Corrosive), RQ	D002
Sulfuric Acid H_2SO_4, Oil of Vitriol	Waste Sulfuric Acid, Spent	Corrosive Material	UN1832	(EPA-Corrosive), RQ	D002
	Batteries (Lead-Acid)				
Lead-Acid Batteries (Excluding Those Sent for Recycling)	Battery, Electric Storage, Wet, Filled with Acid	Corrosive Material	UN2794	(EPA-Corrosive), RQ	D002
	Heavy Metal Wastes				
Heavy Metal Solutions Aqueous Washing Solutions from Ink Formulation, Ink Tub Washwater	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(K086), RQ	K086

Table C-5 (Continued)

Waste Designation	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				EPA Hazardous Waste No.
	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	
		Ignitable Wastes--NOS			
Ignitable Wastes, NOS, Petroleum Distillates	Waste Combustible Liquid, NOS	Combustible Liquid	NA1993	(EPA-Ignitable), RQ	D001
	Waste Flammable Liquid, NOS	Flammable Liquid	UN1993	(EPA-Ignitable), RQ	D001
Ignitable Wastes, NOS, Solvents	Waste Flammable Solid, NOS	Flammable Solid	UN1325	(EPA-Ignitable), RQ	D001
	Waste Petroleum Distillates	Flammable Liquid	UN1268	(EPA-Ignitable), RQ	D001
		Ink			
Sludges with Chromium or Lead:					
Ink Sludge with Chromium or Lead	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(K086), RQ	K086
Ink Sludge Containing Heavy Metals	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(K086), RQ	K086
Waste:					
Various Constituent Solvents:					
Benzene	Waste Ink	Combustible Liquid	UN2867	(F005), RQ	F005
	Waste Ink	Flammable Liquid	UN1210	(F005), RQ	F005
Carbon Tetrachloride	Waste Ink	Combustible Liquid	UN2867	(F001), RQ	F001
	Waste Ink	Flammable Liquid	UN1210	(F001), RQ	F001
Chloroform	Waste Ink	Combustible Liquid	UN2867	(U044), RQ	U044
	Waste Ink	Flammable Liquid	UN1210	(U044), RQ	U044
1,2-Dichloroethane	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001

Table C-5 (Continued)

Waste Designation	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				EPA Hazardous Waste No.
	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	
Ethyl Benzene	Waste Ink	Combustible Liquid	UN2867	(F003), RQ	F003
	Waste Ink	Flammable Liquid	UN1210	(F003), RQ	F003
Methylene Chloride	Waste Ink	Combustible Liquid	UN2867	(F002), RQ	F002
	Waste Ink	Flammable Liquid	UN1210	(F002), RQ	F002
Tetrachloroethylene	Waste Ink	Combustible Liquid	UN2867	(F002), RQ	F002
	Waste Ink	Flammable Liquid	UN1210	(F002), RQ	F002
Toluene	Waste Ink	Combustible Liquid	UN2867	(F005), RQ	F005
	Waste Ink	Flammable Liquid	UN1210	(F005), RQ	F005
1,1,1-Trichloroethane	Waste Ink	Combustible Liquid	UN2867	(F002), RQ	F002
	Waste Ink	Flammable Liquid	UN1210	(F002), RQ	F002
Trichloroethylene	Waste Ink	Combustible Liquid	UN2867	(F002), RQ	F002
	Waste Ink	Flammable Liquid	UN1210	(F002), RQ	F002
Various Constituents from Pigments:					
Aluminum	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001
Cadmium	Waste Ink	Combustible Liquid	UN2867	(EPA-EP Toxic), RQ	D006
	Waste Ink	Flammable Liquid	UN1210	(EPA-EP Toxic), RQ	D006
Chromium	Waste Ink	Combustible Liquid	UN2867	(EPA-EP Toxic), RQ	D007
	Waste Ink	Flammable Liquid	UN1210	(EPA-EP Toxic), RQ	D007
Cobalt	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Copper	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001
Cyanide	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001
Lead	Waste Ink	Combustible Liquid	UN2867	(EPA-EP Toxic), RQ	D008
	Waste Ink	Flammable Liquid	UN1210	(EPA-EP Toxic), RQ	D008
Nickel	Waste Ink	Combustible Liquid	UN2867	(EPA-Ignitable), RQ	D001
	Waste Ink	Flammable Liquid	UN1210	(EPA-Ignitable), RQ	D001
		Paint Wastes			
Benzene Benzol	Waste Benzene	Flammable Liquid	UN1114	(F005), RQ	F005
Chlorobenzene Monochlorobenzene, Phenylchloride	Waste Chlorobenzene	Flammable Liquid	UN1134	(F002), RQ	F002
Combustible Liquid	Waste Combustible Liquid, NOS	Combustible Liquid	NA1993	(EPA-Ignitable), RQ	D001
Enamel	Waste Compound, Enamel	Flammable Liquid	NA1263	(EPA-Ignitable), RQ	D001
Ethyl Benzene	Waste Ethyl Benzene	Flammable Liquid	UN1175	(F003), RQ	F003
Ethylene Dichloride 1,2-Dichloroethane	Waste Ethylene Dichloride	Flammable Liquid	UN1184	(EPA-Ignitable), RQ	D001
Flammable Liquid	Waste Flammable Liquid, NOS	Flammable Liquid	UN1993	(EPA-Ignitable), RQ	D001

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Heavy Metal Paints with:					
Chromium	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(EPA-EP Toxic), RQ	D007
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(EPA-EP Toxic), RQ	D007
Lead	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(EPA-EP Toxic), RQ	D008
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(EPA-EP Toxic), RQ	D008
Methyl Ethyl Ketone MEK, Methyl Acetone, Meetco, Butanone, Ethyl Methyl Ketone, 2-Butanone	Waste Methyl Ethyl Ketone	Flammable Liquid	UN1193	(F005), RQ	F005
Methyl Isobutyl Ketone Shell MIBK	Waste Flammable Liquid, NOS	Flammable Liquid	UN1993	(F003), RQ	F003
Paint, Enamel, Lacquer, Stain, Shellac, Varnish, Polishes, Fillers, Lacquer Base, and Thinners	Waste Paints, Enamels, Lacquers, Stains, Shellac, Varnish, Polishes, Fillers, Lacquer Base, Thinners	Flammable Liquid	UN1263	(EPA-Ignitable), RQ	D001
	Waste Paints, Enamels, Lacquers, Stains, Shellac, Varnish, Polishes, Fillers, Lacquer Base, Thinners	Combustible Liquid	UN1263	(EPA-Ignitable), RQ	D001
Paint Dryer	Waste Paint Dryer, Liquid	Combustible Liquid	UN1168	(EPA-Ignitable), RQ	D001
	Flammable Liquid		UN1168	(EPA-Ignitable), RQ	D001
Toluene Toluol	Waste Toluene	Flammable Liquid	UN1294	(F005), RQ	F005
	Photographic Processing Wastes				
Carbon Tetrachloride Perchloromethane, Necatorina, Benzinoform, CCl_4	Waste Carbon Tetrachloride	ORM-A	UN1846	(U211), RQ	U211

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Cyanide-Containing Liquids	Cyanide Solution, NOS	Poison B	UN1935	(P030), RQ	P030
Heavy-Metal-Containing Liquids Photographic Processing Waste Containing:					
Cadmium	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(D006), RQ	D006
Chromium	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(D007), RQ	D007
Lead	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(D008), RQ	D008
Silver	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(D011), RQ	D011
Trichloroethylene Trichloroethene, Ethinyl Trichloride, Tri-Clene, Trielene, Tri	Waste Trichloroethylene	ORM-A	UN1710	(F002), RQ	F002
		Plating Wastes			
Spent Plating Wastes: Wastewater Treatment Sludges from Electroplating Operations Except from the Following Processes: (1) Sulfuric Acid Anodizing of Aluminum, (2) Tin Plating on Carbon Steel, (3) Zinc Plating (Segregated Basis) on Carbon Steel, (4) Aluminum or Zinc-Aluminum Plating on Carbon Steel, (5) Cleaning and Stripping Associated with Tin, Zinc, and Aluminum Plating on Carbon Steel, and (6) Chemical Etching and Milling of Aluminum	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(F006), RQ	F006
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(F006), RQ	F006

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class^a	Identification No.	Additional Information^b	EPA Hazardous Waste No.
Spent Cyanide Plating Bath Solutions from Electroplating Operations	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(F007), RQ	F007
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(F007), RQ	F007
Plating Sludges from the Bottom of Plating Baths from Electroplating Operations Where Cyanides Are Used in the Process	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(F008), RQ	F008
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(F008), RQ	F008
Spent Stripping and Cleaning Bath Solutions from Electroplating Operations Where Cyanides Are Used in the Process	Hazardous Waste, Solid, NOS	ORM-E	NA9189	(F009), RQ	F009
	Hazardous Waste, Liquid, NOS	ORM-E	NA9189	(F009), RQ	F009
	Solvent Wastes (see also Paint Wastes)				
Acetone	Waste Acetone	Flammable Liquid	UN1090	(F003), RQ	F003
Aromatic Hydrocarbons	Waste Flammable Liquid, NOS	Flammable Liquid	UN1993	(EPA-Ignitable), RQ	D001
	Waste Combustible Liquid, NOS	Combustible Liquid	NA1993	(EPA-Ignitable), RQ	D001
Benzene Benzol	Waste Benzene	Flammable Liquid	UN1114	(F005), RQ	F005
n-Butyl Acetate	Waste *n*-Butyl Acetate	Flammable Liquid	UN1123	(EPA-Ignitable), RQ	D001
n-Butyl Alcohol *sec*-Butyl Alcohol, *tert*-Butyl Alcohol	Waste Butyl Alcohol	Flammable Liquid	NA1120	(F003), RQ	F003
Carbon Tetrachloride Carbon Tet, Tetrachloromethane, Perchloromethane, Tetraform, Carbona, Halon 104, Necatorina, Benzinoform, CCl_4	Waste Carbon Tetrachloride	ORM-A	UN1846	(F001), RQ	F001

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Chlorobenzene Monochlorobenzene, Phenylchloride	Waste Chlorobenzene	Flammable Liquid	UN1134	(F002), RQ	F002
Chloroform Trichloromethane	Waste Chloroform	ORM-A	UN1888	(U044), RQ	U044
Dichlorobenzene *o*-Dichlorobenzene	Waste Dichlorobenzene, Ortho, Liquid	ORM-A	UN1591	(F002), RQ	F002
1,4-Dioxane Diethylene Ether, 1,4-Diethylene Oxide, Diethylene Oxide, Dioxyethylene Ether	Waste Dioxane	Flammable Liquid	UN1165	(EPA-Ignitable), RQ	D001
Ethanol Ethyl Alcohol, Grain Alcohol	Waste Ethyl Alcohol	Flammable Liquid	UN1170	(EPA-Ignitable), RQ	D001
Ethyl Acetate	Waste Ethyl Acetate	Flammable Liquid	UN1173	(F003), RQ	F003
Ethyl Benzene	Waste Ethyl Benzene	Flammable Liquid	UN1175	(F003), RQ	F003
Ethyl Ether Ether, Diethyl Ether, Diethyl Oxide	Waste Ethyl Ether	Flammable Liquid	UN1155	(EPA-Ignitable), RQ	D001
Ethylene Dichloride 1,2-Dichloroethane	Waste Ethylene Dichloride	Flammable Liquid	UN1184	(EPA-Ignitable), RQ	D001
Formalin Formaldehyde Solution: FlashPoint Greater Than 141 °F:					
- Containers of 110 Gallons or Less	Waste Formaldehyde Solution	ORM-A	UN2209	(U122), RQ	U122
- Containers of More Than 110 Gallons	Waste Formaldehyde Solution	Combustible Liquid	UN2209	(U122), RQ	U122

Table C-5 (Continued)

Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
FlashPoint Less Than or Equal To 141 °F:					
- Containers of 110 Gallons or Less	Waste Formaldehyde Solution	ORM-A	UN1198	(EPA-Ignitable), RQ	D001
- Containers of More Than 110 Gallons	Waste Formaldehyde Solution	Combustible Liquid	UN1198	(EPA-Ignitable), RQ	D001
Glycol Ethers May include Numerous Compounds, Including Diethylene Glycol and Hexylene Glycol	Waste Combustible Liquid, NOS	Combustible Liquid	NA1993	(EPA-Ignitable), RQ	D001
Heptane Heptane	Waste Heptane	Flammable Liquid	UN1206	(EPA-Ignitable), RQ	D001
Hexachloroethane 1,1,1,2,2,2-Hexachloroethane	Waste Hexachloroethane	ORM-A	NA9037	(U131), RQ	U131
Hexane *n*-Hexane	Waste Hexane	Flammable Liquid	UN1208	(EPA-Ignitable), RQ	D001
Ignitable Liquids	Waste Flammable Liquids, NOS Waste Combustible Liquids, NOS	Flammable Liquid Combustible Liquid	UN1993 NA1993	(EPA-Ignitable), RQ (EPA-Ignitable), RQ	D001 D001
Isopropanol Isopropyl Alcohol, TPA, Dimethyl Carbinol, 2-Propanol	Waste Isopropanol	Flammable Liquid	UN1219	(EPA-Ignitable), RQ	D001
Isopropyl Acetate Isopropyl Acetate	Waste Isopropyl Acetate	Flammable Liquid	UN1220	(EPA-Ignitable), RQ	D001
Kerosene Kerosene, Fuel Oil No. 1	Waste Kerofene	Combustible Liquid	UN1223	(EPA-Ignitable), RQ	D001

Table C-5 (Continued)

Waste Designation	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				EPA Hazardous Waste No.
	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	
Methanol Methyl Alcohol, Wood Alcohol	Waste Methyl Alcohol	Flammable Liquid	UN1230	(F003), RQ	F003
Methyl Ethyl Ketone Methyl Acetone, Meetco, Butanone, MEK, 2-Butanone, Ethyl Methyl Ketone	Waste Methyl Ethyl Ketone	Flammable Liquid	UN1193	(F005), RQ	F005
Methyl Isobutyl Ketone MIBK	Waste Flammable Liquid, NOS	Flammable Liquid	UN1993	(F003), RQ	F003
Methylene Chloride Dichloromethane, Methane Dichloride, Methylene Bichloride, MCI-CS0102, Methylene Dichloride, Solaesthin, Aerothene MM, Narkotil, Solmethine	Waste Methylene Chloride	ORM-A	UN1593	(F001), RQ (F002), RQ	F001[e] F002[f]
Naphtha Mineral Spirits, V.M.&P. Naphtha, White Spirits	Waste Naphtha Waste Naphtha	Combustible Liquid Flammable Liquid	UN2553 UN2553	(EPA-Ignitable), RQ (EPA-Ignitable), RQ	D001 D001
Pentane	Waste Pentane	Flammable Liquid	UN1265	(EPA-Ignitable), RQ	D001
Perchloroethylene Perc, Tetrachloroethylene	Waste Perchloroethylene	ORM-A	UN1897	(F001), RQ (F002), RQ	F001[e] F002[f]
Petroleum Distillate	Waste Petroleum Distillate Waste Petroleum Distillate	Combustible Liquid Flammable Liquid	UN1268 UN1268	(EPA-Ignitable), RQ (EPA-Ignitable), RQ	D001 D001
Petroleum Ether	Waste Petroleum Ether	Flammable Liquid	UN1271	(EPA-Ignitable), RQ	D001
Petroleum Solvents	Waste Petroleum Distillate Waste Petroleum Naphtha Waste Petroleum Naphtha	Combustible Liquid Combustible Liquid Flammable Liquid	UN1268 UN1255 UN1255	(EPA-Ignitable), RQ (EPA-Ignitable), RQ (EPA-Ignitable), RQ	D001 D001 D001

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Phenol	Waste Phenol Waste Phenol (tar acid containing over 50% phenol)	Poison B Poison B	UN1671 NA2821	(U188), RQ (U188), RQ	U188 U188
Propyl Alcohol Propanol	Waste Propyl Alcohol	Flammable Liquid	UN1274	(EPA-Ignitable), RQ	D001
Tetrachloroethylene Perchloroethylene, Perc, Tetralex, Perawin, Perclene, Terlen, Didakene, TetraCap, Antisal 1, Fedad-UN, Neme Gemalgene, Perm-A-Clor, TCE, Benzinol, Dow-Tri, Nialk, Vestrol, Trielin, PCE	Waste Tetrachloroethylene	ORM-A	UN1897	(F001), RQ (F002), RQ	F001[e] F002[f]
Tetrahydrofuran THF	Waste Tetrahydrofuran	Flammable Liquid	UN2056	(EPA-Ignitable), RQ	D001
Toluene Methacide, Methylbenzene, Methylbenzol, Phenylmethane, Toluol, Antisal 1A	Waste Toluene	Flammable Liquid	UN1294	(F005), RQ	F005
Toluene Diisocyanate	Waste Toluene Diisocyanate	Poison B	UN2078	(U223), RQ	U223
1,1,1-Trichloroethane Aerothane TT, Chlorten, Inhibisol, Trichloroethane, Chlorothene NU, NCI-C04626, Methylchloroform, Chlorothene VG, Chlorothane NU, Chlorotene	Waste 1,1,1-Trichloroethane	ORM-A	UN2831	(F001), RQ (F002), RQ	F001[e] F002[f]

Table C-5 (Continued)

	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				
Waste Designation	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	EPA Hazardous Waste No.
Trichloroethylene Perm-A-chlor, Trielin, Triline, Triol, Vestrol, Chlorylene, Dow-Tri, Vitran, TCE, Nialk, Philex, Tri-Clene	Waste Trichloroethylene	ORM-A	UN1710	(F001), RQ (F002), RQ	F001 F002
Trichlorotrifluoroethane Fluorocarbon 113, Freon 113, Ucon 113, Frigen 113, 113TR-T, Eskimon 11, Ucon 11, Isotron 11, Freon 11, Freon MF, Fluorochloroform, Arcton 9, Freon TE-35, Freon T-ES 35, Freon TMC, Freon TF, Arcton 63	*Hazardous Waste, Liquid, NOS*	*ORM-E*	NA9189	(F001), RQ (F002), RQ	F001 F002
Valclene	Hazardous Waste, NOS	ORM-E	UN9189	(F002), RQ	F002
Varsol	Waste Naphtha	Flammable Liquid	UN1256	(EPA-Ignitable), RQ	D001
White Spirits, Mineral Spirits, Naphtha	Waste Naphtha	Combustible Liquid	UN1256	(EPA-Ignitable), RQ	D001
White Spirits, Varsol	Waste Naphtha	Flammable Liquid	UN2553	(EPA-Ignitable), RQ	D001
Mineral Spirits, Naphtha	Waste Naphtha	Combustible Liquid	UN2553	(EPA-Ignitable), RQ	D001

Table C-5 (Continued)

Waste Designation	DOT Information for Item 11 of the Uniform Hazardous Waste Manifest				EPA Hazardous Waste No.
	DOT Proper Shipping Name	Hazard Class[a]	Identification No.	Additional Information[b]	
Xylene Xylol, Dimethyl Benzene	Waste Xylene	Flammable Liquid	UN1307	(F003), RQ	F003

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[a] "Combustible" means that the flashpoint is less than 200 °F and greater than or equal to 100 °F; "flammable" means that the flashpoint is less than 100 °F.

[b] The EPA hazardous waste number may be used in parenthesis in place of "EPA-" and the characteristic. The letters "RQ" may also appear before the DOT proper shipping name. "RQ" is only required for materials that contain 100 lbs. in one package, that are wastes, and that exhibit the characteristics of ignitability, corrosivity, or reactivity.

[c] EP toxic, Extraction Procedure toxic.

[d] NOS, Not otherwise specified.

[e] Degreasing use.

[f] Other use.

APPENDIX D

SOURCES OF ADDITIONAL INFORMATION

CONTENTS

D.1 U.S. EPA Regional Offices D-1
D.2 State Hazardous Waste Management Agencies D-3

The following sources are available for assistance to educational institutions in identifying and minimizing hazardous waste generation. These include the EPA RCRA/Superfund Hotline (1-800-424-9346; in Washington, D.C., 382-3000) and the EPA Small Business Ombudsman Hotline (1-800-368-5888; in Washington, D.C., 557-1938). The National Response Center's function is to receive reports of hazardous substance releases under CERCLA, oil discharges under the Clean Water Act, and certain spill reporting requirements under RCRA (e.g., §265.56(d)(2)) (1-800-424-8802; in Washington, D.C., 267-2675).

Many State hazardous waste management agencies and EPA regional offices provide information to small businesses to help them identify and minimize hazardous waste. This information could also help educational institutions. An earlier EPA publication, *Understanding the Small Quantity Generator Hazardous Waste Rules: A Handbook for Small Business,* contains complete information for contacting State hazardous waste management agencies and EPA regional offices. The handbook is widely available from trade associations, State agencies, and the EPA RCRA/Superfund Hotline.

For facilities in States authorized to implement the RCRA hazardous waste program, the authorized States are the best sources of additional information. The best sources of information on facilities in States not yet authorized (marked "unauthorized" in Section D.2) are the appropriate EPA Regional Offices. The information on regional and State sources of information in Sections D.1 and D.2 is current as of June 1, 1988.

D.1 U.S. EPA REGIONAL OFFICES

EPA Region I (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
State Waste Programs Branch
JFK Federal Building
Boston, MA 02203
(617) 565-3698

EPA Region II (New Jersey, New York, Puerto Rico, Virgin Islands)
Air and Waste Management Division
26 Federal Plaza
New York, NY 10278
(212) 264-5175

EPA Region III (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)
Waste Management Branch
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-0980

EPA Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)
Hazardous Waste Management Division
345 Courtland Street, NE.
Atlanta, GA 30365
(404) 347-3016

EPA Region V (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)
RCRA Activities Section
230 South Dearborn Street
Chicago, IL 60604
(312) 886-4434

EPA Region VI (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)
Air and Hazardous Materials Division
1445 Ross Avenue
Dallas, TX 75202
(214) 655-6750

EPA Region VII (Iowa, Kansas, Missouri, Nebraska)
RCRA Branch
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2852

EPA Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)
RCRA Implementation Branch
Waste Management Division (8HWM-RI)
999 18th Street, Suite 500
Denver, CO 80202-2405
(303) 293-1800
For Colorado and Montana: (303) 293-1798
For North Dakota and Utah: (303) 293-1500
For South Dakota and Wyoming: (303) 293-1790

EPA Region IX (American Samoa, Arizona, California, Guam, Hawaii, Nevada, Trust Territories of the Pacific)
Toxics and Waste Management Division
215 Fremont Street
San Francisco, CA 94105
(415) 974-7472

EPA Region X (Alaska, Idaho, Oregon, Washington)
Waste Management Branch (HW-112)
1200 6th Avenue
Seattle, WA 98101
(206) 442-2777

D.2 STATE HAZARDOUS WASTE MANAGEMENT AGENCIES

Alabama
Alabama Department of Environmental Management
Land Division
1751 Federal Drive
Montgomery, AL 36130
(205) 271-7730

Alaska (Unauthorized) (Call Regional Office first)
Department of Environmental Conservation
P.O. Box 0
Juneau, AK 99811
Program Manager: (907) 465-2666
Northern Regional Office (Fairbanks): (907) 452-1714
South-Central Regional Office (Anchorage): (907) 563-6529
Southeast Regional Office (Juneau): (907) 789-3151

American Samoa
Environmental Quality Commission
Government of American Samoa
Pago Pago, American Samoa 96799
Call regional office for Hawaii
Overseas operator (commercial call, (684) 663-4116)

Arizona
Arizona Department of Health Services
Office of Waste and Water Quality
2005 North Central Avenue, Room 304
Phoenix, AZ 85004
Hazardous Waste Management: (602) 257-2211

Arkansas
Department of Pollution Control and Ecology
Hazardous Waste Division
P.O. Box 9583
8001 National Drive
Little Rock, AR 72219
(501) 562-7444

California (Unauthorized) (Call Regional Office first)
Department of Health Services
Toxic Substances Control Division
714 P Street, Room 1253
P.O. Box 942732
Sacramento, CA 94234-7230
(916) 324-1826

or

State Water Resources Control Board
Division of Water Quality
P.O. Box 100
Sacramento, CA 95801
(916) 322-2867

Colorado
Colorado Department of Health
Waste Management Division
4210 East 11th Avenue
Denver, CO 80220
(303) 320-8333 (ext. 4364)

Connecticut (Unauthorized) (Call Regional Office first)
Department of Environmental Protection
Hazardous Waste Management Section
State Office Building
165 Capitol Avenue
Hartford, CT 06106
(203) 566-8843, -8844

Delaware
Department of Natural Resources and Environmental Control
Waste Management Section
89 Kings Highway
P.O. Box 1401
Dover, DE 19903
(302) 736-4781

District of Columbia
Department of Consumer and Regulatory Affairs
Pesticides and Hazardous Waste Management Branch
Room 114
5010 Overlook Avenue, SW.
Washington, DC 20032
(202) 783-3192

Florida
Department of Environmental Regulation
Solid and Hazardous Waste Section
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400
(904) 488-0300

Georgia
Georgia Environmental Protection Division
Hazardous Waste Management Program
Land Protection Branch
Floyd Towers East, Suite 1154
205 Butler Street, SE.
Atlanta, GA 30334
(404) 656-2833; toll free, (800) 334-2373

Guam
Guam Environmental Protection Agency
P.O. Box 2999
Agana, GU 96910
Call regional office for Hawaii
Overseas operator (commercial call, (671) 646-7579)

Hawaii (Unauthorized) (Call Regional Office first)
Department of Health
Noise and Radiation Division
P.O. Box 3378
Honolulu, HI 96801
(808) 548-4383

Idaho (Unauthorized) (Call Regional Office first)
Department of Health and Welfare IDHW-DEQ
Bureau of Hazardous Materials
Towers Building, 3d Floor
450 West State Street
Boise, ID 83720
(208) 334-5879

Illinois
Environmental Protection Agency
Division of Land Pollution Control
2200 Churchill Road
P.O. Box 19276
Springfield, IL 62794-9276
(217) 782-6761

Indiana
Department of Environmental Management
Office of Solid and Hazardous Waste
105 South Meridian Street
Indianapolis, IN 46225
(317) 232-4518, -4535

Iowa (Unauthorized) (Call Regional Office first)
U.S. EPA Region VII
Hazardous Materials Branch
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2887

Kansas
Department of Health and Environment
Bureau of Waste Management
Forbes Field, Building 730
Topeka, KS 66620
(913) 296-1500, -1607

Kentucky
Natural Resources and Environmental Protection Cabinet
Division of Waste Management
18 Reilly Road
Frankfort, KY 40601
(502) 564-6716

Louisiana
Department of Environmental Quality
Hazardous Waste Division
P.O. Box 44307
Baton Rouge, LA 70804
(504) 342-4677

Maine
Department of Environmental Protection
Bureau of Oil and Hazardous Materials Control
State House Station No. 17
Augusta, ME 04333
(207) 289-2651

Maryland
Department of Health and Mental Hygiene
Maryland Waste Management Administration
Office of Environmental Programs
201 West Preston Street, Room 2A3
Baltimore, MD 21201
(301) 225-5709

Massachusetts
Department of Environmental Quality Engineering
Division of Solid and Hazardous Waste
1 Winter Street, 5th Floor
Boston, MA 02108
(617) 292-5589, -5851

Michigan
Michigan Department of Natural Resources
Hazardous Waste Division
Waste Evaluation Unit
Box 30028
Lansing, MI 48909
(517) 373-2730

Minnesota

Pollution Control Agency
Solid and Hazardous Waste Division
520 Lafayette Road North
St. Paul, MN 55155
(612) 296-6300, 297-1784

Mississippi

Department of Natural Resources
Division of Solid and Hazardous Waste Management
P.O. Box 10385
Jackson, MS 39209
(601) 961-5062

Missouri

Department of Natural Resources
Waste Management Program
P.O. Box 176
Jefferson City, MO 65102
(314) 751-3176
Missouri Hotline: (800) 334-6946

Montana

Department of Health and Environmental Sciences
Solid and Hazardous Waste Bureau
Cogswell Building, Room B-201
Helena, MT 59620
(406) 444-2821

Nebraska

Department of Environmental Control
Hazardous Waste Management Section
Call No. 98922
State House Station
Lincoln, NE 68509-8922
(402) 471-2186

Nevada

Division of Environmental Protection
Waste Management Program
201 South Fall, Room 120
Carson City, NV 89710
(702) 885-4670, -5872

New Hampshire

Department of Environmental Services
Waste Management Division
6 Hazen Drive
Concord, NH 03301-6509
(603) 271-2942

New Jersey
Department of Environmental Protection
Division of Waste Management
401 East State Street
Trenton, NJ 08625
Hazardous Waste Advisement Program: (609) 292-8341, -9880

New Mexico
Environmental Improvement Division
Hazardous Waste Section
P.O. Box 968
Santa Fe, NM 87504-0968
(505) 827-2922

New York
Department of Environmental Conservation
Bureau of Hazardous Waste Operations
50 Wolf Road, Room 207
Albany, NY 12233
(518) 457-0530
New York Small Quantity Generator Hotline: (800) 631-0666

North Carolina
Department of Human Resources
Solid and Hazardous Waste Management Branch
P.O. Box 2091
Raleigh, NC 27602
(919) 733-2178

North Dakota
Department of Health
Division of Hazardous Waste Management and Special Studies
1200 Missouri Avenue, Room 302
Bismarck, ND 58502-5520
(701) 224-2366

Northern Mariana Islands, Commonwealth of
Department of Environmental and Health Services
Division of Environmental Quality
P.O. Box 1304
Saipan, Commonwealth of Mariana Islands 96950
Call regional office for Hawaii
Overseas call, (670) 234-6984

Ohio (Unauthorized) (Call Regional Office first)
Ohio EPA
Division of Solid and Hazardous Waste Management
1800 Water Mark Drive
P.O. Box 1049
Columbus, OH 43266-0149
(614) 644-2956, -2934

Oklahoma

Waste Management Service
Oklahoma State Department of Health
1000 Northeast 10th Street
P.O. Box 53551
Oklahoma City, OK 73152
(405) 271-5338

Oregon

Department of Environmental Quality
Hazardous and Solid Waste Division
811 Southwest 6th Avenue
Portland, OR 97204
(503) 229-5913
Toll free: (800) 452-4011

Pennsylvania

Department of Environmental Resources
Bureau of Waste Management
Division of Compliance Monitoring
P.O. Box 2063
Harrisburg, PA 17120
(717) 787-6239, -9870

Puerto Rico (Unauthorized) (Call Regional Office first)

Environmental Quality Board
P.O. Box 11488
Santurce, PR 00910-1488
(809) 723-8184

Rhode Island

Department of Environmental Management
Division of Hazardous Waste
Cannon Building, Room 204
75 Davis Street
Providence, RI 02908
(401) 277-2797

South Carolina

Department of Health and Environmental Control
Bureau of Solid and Hazardous Waste Management
2600 Bull Street
Columbia, SC 29201
(803) 734-5200

South Dakota

Department of Water and Natural Resources
Office of Air Quality and Solid Waste
Foss Building, Room 416
Pierre, SD 57501
(605) 773-3153

Tennessee
Division of Solid Waste Management
Tennessee Department of Public Health
Customs House, 4th Floor
701 Broadway
Nashville, TN 37219-5403
(615) 741-3424

Texas
Texas Water Commission
Attn: Hazardous and Solid Waste Division
Compliance Assistance Unit
P.O. Box 13807, Capitol Station
Austin, TX 78711-3087
(512) 463-7760

Utah
Department of Health
Bureau of Solid and Hazardous Waste Management
288 North 1460 West
P.O. Box 16700
Salt Lake City, UT 84116-0700
(801) 538-6170

Vermont
Agency of Environmental Conservation
Waste Management Division
103 South Main Street
Waterbury, VT 05676
(802) 244-8702

Virgin Islands (Unauthorized) (Call Regional Office first)
Department of Conservation and Cultural Affairs
P.O. Box 4399
Charlotte Amalie, St. Thomas, VI 00801
(809) 774-3320

Virginia
Department of Health
Division of Solid and Hazardous Waste Management
Monroe Building, 11th Floor
101 North 14th Street
Richmond, VA 23219
(804) 225-2667
Hazardous Waste Hotline: (800) 552-2075

Washington
Department of Ecology
Solid and Hazardous Waste Program
Mail Stop PV-11
Olympia, WA 98504-8711
(206) 459-6322, -6305, -6913
In-State: 1-800-633-7585 (for disposal of household hazardous waste)

West Virginia
Waste Management Division
1260 Greenbrier Street
Charleston, WV 25311
(304) 348-5935

Wisconsin
Department of Natural Resources
Bureau of Solid Waste Management
P.O. Box 7921
Madison, WI 53707
(608) 267-7554

Wyoming (Unauthorized) (Call Regional Office first)
Department of Environmental Quality
Solid Waste Management Program
122 West 25th Street
Cheyenne, WY 82002
(307)777-7752

APPENDIX E

ORGANIZATIONS COMMENTING ON THE REPORT

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E.1 FEDERAL AGENCIES

U.S. Department of Education:

- Office of the Assistant Secretary for Vocational and Adult Education
- Office of Special Education and Rehabilitative Services

E.2 STATES

- Connecticut (Department of Environmental Protection)
- Illinois (Environmental Protection Agency)
- Maryland (Department of the Environment)
- Nebraska (Department of Environmental Control)
- New Hampshire (Department of Education)
- New Jersey (Department of Education)
- Texas (Water Commission)
- Wisconsin (Board of Vocational, Technical and Adult Education)

E.3 EDUCATIONAL AND OTHER ASSOCIATIONS

- American Association of School Administrators
- American Chemical Society
- Association of State and Territorial Solid Waste Management Officials (forwarded three States' comments)
- National Association of College and University Business Officers

E.4 UNIVERSITIES AND OTHER EDUCATIONAL INSTITUTIONS

- Washington State University
- University of Washington
- University of Illinois at Urbana-Champaign

APPENDIX F

RESPONSES TO QUESTIONS ON EPA's HAZARDOUS WASTE MANAGEMENT REGULATIONS

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F.1 REUSE OF REAGENTS

Comment:

EPA should encourage recycling and reuse of discarded laboratory reagents. (American Chemical Society (ACS), October 23, 1987; University of Illinois at Urbana-Champaign, October 18, 1987)

Response:

EPA interprets this comment as referring to the reuse of unwanted laboratory reagents. Section 261.2 of 40 CFR defines a solid waste as any *discarded* material, which has been abandoned, recycled, or considered inherently wastelike. Section 261.2(e) states that materials are not solid wastes when they can be shown to be recycled or reused as effective substitutes for commercial products. Laboratory reagents that are physically located in stockrooms and awaiting transfer from one user to another, are covered by §261.2(e); that is, they are not solid wastes.

F.2 LAND DISPOSAL OF LAB PACKS

Comment:

EPA should reauthorize the landfilling of laboratory waste in lab packs, with certain restrictions, because lab packs represent an exceptionally small percentage of the total wastes now being landfilled and there are no feasible alternative disposal options for small quantities of some materials. Additionally, in some cases, there are no economical alternatives to disposal of these materials in landfills. (ACS, October 23, 1987)

Response:

Section 3004(d)(2)(B) of the Resource Conservation and Recovery Act (RCRA) prohibits land disposal of wastes containing certain metals above specific concentrations. RCRA Section 3004(e)(2)(B) prohibits the land disposal of flammable solvents (if they are categorized under EPA Hazardous Waste Number F003). Furthermore, RCRA requires EPA to ban the land disposal of untreated wastes on a schedule published on May 28, 1986. EPA cannot postpone implementing present and proposed bans on the land disposal of hazardous wastes, but these actions are required by law.

The reader should note, however, that wastes from conditionally exempt small quantity generators are not subject to the land disposal restrictions regulations (40 CFR 268), provided that these wastes are managed in accordance with regulations under §261.5.

F.3 BATCH TREATMENT OF WASTES

Comment:

EPA should allow batch treatment of laboratory wastes in quantities not exceeding five gallons under controlled conditions. (ACS, October 23, 1987)

Response:

EPA regulations already allow certain types of on-site treatment in elementary neutralization units and wastewater treatment units (as defined in 40 CFR 260.10), in tanks under §262.34(a) and (d), and in reclamation devices (under §261.6(c) because the recycling process itself is exempt from regulation).

F.4 WASTE MINIMIZATION CERTIFICATION

Comment:

Only large quantity generators are required to certify waste minimization efforts on manifests. Only a few schools, mostly large universities, are regulated as large quantity generators. (ACS, October 23, 1987)

Response:

The comment is incorrect. RCRA Section 3002(b) requires that the manifest for a large quantity generator certify that it has a program to reduce the volume or quantity and toxicity of the waste and that the proposed method of treatment, storage, or disposal is one that minimizes the present and future threat to human health and the environment. A rulemaking published in the *Federal Register* (51 FR 35190, October 1, 1986) modifies the requirements for small quantity generators to require waste a minimization certification to read as follows:

"If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford."

F.5 WASTE TREATMENT IN ACCUMULATION TANKS

Comment:

The statement that "all on-site treatment in accumulation tanks also is exempt from regulation" is not accurate. (ACS, October 23, 1987)

Response:

As mentioned in Section F.3, a generator can treat hazardous waste in tanks without a permit under 40 CFR 262.34(a) and (d), as long as the treatment does not fall under any part of the regulations (for example, thermal treatment), and provided that certain requirements are met. However, if a generator accumulates hazardous wastes in tanks or containers for more than 90 days, the generator becomes an operator of a treatment, storage, or disposal facility and becomes subject to the requirements of 40 CFR Parts 264 and 265 and the permit requirements of 40 CFR Part 270.

F.6 LAB PACKS AS DISPOSAL UNITS

Comment:

It is misleading to assume that landfill bans must have a significant impact on the disposal of all laboratory chemicals. The term "lab pack" is now far more appropriate in describing a packaging unit rather than a disposal unit. . . . (ACS, October 23, 1987)

Response:

The Hazardous and Solid Waste Amendments of 1984 did not specifically address lab packs. If lab packs contain banned hazardous wastes, they are prohibited from being land disposed. Lab packs may be used as storage, transportation, and, if they do not contain banned wastes, disposal units.

F.7 DEFINITION OF "ON-SITE"

Comment:

Many colleges and universities have asked for clarification on the issue of filing for generator identification numbers and the determination of eligibility for status as a small quantity generator. Most of these institutions would like to file for only one identification number for the many buildings situated on their campuses so that they can maintain single "administrative umbrellas" over their several individual points of generation (for example, laboratories, central chemical storage areas, maintenance shops, power plants). The physical layouts of many campuses tend to confuse the issue of how many notification forms to file. Some campuses, especially those located in metropolitan areas, may be divided by public roads, and this further complicates determination of generator status. Can a university consider itself as one generation site in order to spread its administrative umbrella over the entire campus?

Response:

Several basic configurations exist for college campuses. The rural or suburban campus might have several buildings on one contiguous piece of property. This would be considered a single or individual generation site even though one or more hazardous wastes are generated from one or more sources. One EPA identification number would normally be assigned for the site, and small quantity generator status would be determined by looking at the total hazardous waste generated or accumulated on the site.

Many university campuses are divided by public roads or other rights-of-way that they do not control. Nonetheless, parts of a campus may be geographically contiguous and the entry and exit between the two may be directly across from each other at a crossroads. Such a campus would be one generator for all purposes.

A metropolitan campus may be constructed on a number of city blocks, creating a situation where campus buildings are separated by city streets and it is necessary to travel along public streets to go from one part of the campus to the other. In these cases, each generation site (each city block or each part of the campus) would be a generator (or a small quantity generator) and assigned its own EPA identification number. Hazardous wastes being shipped from one campus building (generator) to another building (a treatment, storage, or disposal facility) where the sites are divided by a public street would need a manifest while on the public street.